## REMARKS

### I. Overview

Applicants note that Appeal Brief filed on September 25, 2006 has resulted in the withdrawal of rejections to claims 1, 4-8, 10-11, 14-15 and 17-19 under 35 U.S.C. § 103(a) by De Vuyst et al. (Microbiology, Vol. 142, 1996, pages 817-827), claims 1, 4-8, 10-15 and 17-19 under 35 U.S.C. § 103(a) by De Vuyst et al., cited above, in view of Nanji (U.S. Patent 5,413,785), and claim 16 under 35 U.S.C. § 103(a) by De Vuyst et al., cited above, in view of Perdigon et al. (J. of Food Protection, Vol. 53, No. 5, pages 404-410, 1996).

Applicant has reviewed and considered the Office Action mailed July 6, 2007. Claim 1 has been amended to recite "exposing said bacteria to biological, chemical or physical stress for at least one or more sequential periods of stress". Support for the amendment may be found throughout the specification, for example, in originally filed claim 1. Claims 6 and 7 have been amended to overcome objection formalities. No new matter has been added. Claims 1, 4-8 and 10-12 and 14-19 are pending in the instant application. In light of the remarks that follow, Applicants respectfully request reconsideration and withdrawal of the rejections.

### II. New Claim Objections

The Examiner states claims 6 and 7 are objected to because of the following informalities: Claim 6 is objected to since genus names should be italicized. Claim 7 is objected to since abbreviations should be spelled out upon their first recitation.

Accordingly, Applicant has adopted the Examiner's suggestion and have amended claims 6 and 7. Applicants respectfully submit that this rejection has been overcome.

## III. Claim Rejections - 35 U.S.C. § 112

Claims 1, 4-6, 8, 10-12 and 14-19 are rejected to under 35 U.S.C. § 112, first paragraph, for alleged lack of enablement. The Examiner states that the specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make/use the invention commensurate in scope with these claims.

The Examiner states that if little is known in the prior art about the nature of the invention and the art is unpredictable, the specification would need more detail as to how to make and use the invention in order to be enabling. (MPEP 2164.03). The MPEP further states that physiological activity can be considered inherently unpredictable. Thus, Applicant assumes a certain burden in establishing that inventions involving physiological activity are enabled.

The Examiner states that the instant specification fails to provide significant direction on which bacteria, other than those set forth in Table 1, are capable of eliciting a modulated immune response when administered to an animal.

Applicant respectfully traverses the rejection. Applicant asserts that the application indeed enables the full scope of the claims. The arguments set forth in the Office Action suggest that not all bacteria subjected to the claimed method will result in eliciting an immune response in an animal when administered, it would require undue experimentation to identify bacteria that express SRFs.

Applicant respectfully disagrees with the Examiner's conclusions which are addressed in turn below. First, the Examiner states that to use the instant invention the skilled artisan must know which bacterial species are capable of producing SRFs in response to the cited stresses that are capable of modulating the immune system upon its administration to an animal. Office Action, at pages 4-5. The Examiner cannot be suggesting that Applicant is required to test all

bacteria for it to be enabled- this simply is not the law. "The test [for enablement] is not merely quantitative, since a considerable amount of experimentation is possible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed." (*In re Wands*, 8 U.S.P.Q.2d 1400 (Fed. Cir. 1988). One skilled in the art would be able to make and use the present invention. Applicants' specification provides ample guidance to the skilled artisan seeking to produce a fraction of <10kDa that includes SRFs from bacteria.

Furthermore, there is no requirement that every possible bacteria produce SRFs when stressed and that the fraction of <10kDa having SRFs possess immunomodulatory activity. Enablement requires that one skilled in the art can identify operative embodiments without engaging in undue experimentation. MPEP § 2164.06. The Federal Circuit has held that claims may encompass some inoperative species, so long as the number of inoperative species does not become significant and force one of ordinary skill in the art into undue experimentation in order to practice the invention. *Altlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 750F.2d 1569, 224 USPQ 409 (Fed. Cir. 1984). Therefore, once the initial discovery was made that the claimed method produces SRFs from stressed bacteria that are capable of modulating the immune system of an animal upon administration, there would be no difficulty in applying the claimed methods' recited steps to any other species or genera of bacteria, nor has the Examiner cited any arguments or evidence of such.

Second, the Examiner states that the specification is silent as to which "product" within the <10kDa fraction is responsible for some modulation and the efficacy of a given <10kDa fraction from a given stressed bacteria has to be determined empirically. Applicant respectfully reminds the Examiner that the claims are directed to methods of modulating the immune system

of an animal – not the SRFs themselves and one skilled in the art would be able to follow the guidance in specification to obtain a fraction from stressed bacteria that is <10kDa that has SRFs.

Third, the Examiner admits that the specification is "enabling for methods for modulating the immune system of an animal ... wherein the bacteria is *Lactobacillus caseii, Lactobacillus acidophilus, Lactobacillus fermentum, Lactobacillus plantarum, Listeria monocytogenes, Staphylococcus aureus, Salmonella typhimurium Pediococcus acidolactici, Bacillus coryneforme, Escherichia coli, Enterococcus faecium, Streptococcus pyogenes or Klebsiella pneumoniae* ". Office Action, page 3. Importantly, the given thirteen species are diverse in scientific taxonomy, for example, representing at least two different phylums and classes, three different orders, five different families, and eight different genera of bacteria. See attached reference - TAXONOMIC OUTLINE OF THE PROKARYOTES BERGEY'S MANUAL OF SYSTEMIC BACTERIOLOGY, (2nd Edition 2004), in particular pages 114, 118, 122, 181, 186, 190-92, 194-95, 197, 200 and 299 (cited on the IDS and submitted herewith). The phenetic classification of these thirteen species into categories such as colony morphology, cell shape and arrangement, cell wall structure (Gram staining), virulence as a pathogen to humans, ability to form spores, natural habitat, and requirement for oxygen is diverse as well. The named species include those that are rods (bacilli), spheres (cocci), stain Gram-negative, Gram-positive, virulent and non-virulent pathogens, spore-formers, non-spore formers, and those that are aerobic and anaerobic. See attached references showing diversity – in particular pages 412, 413, 476, 478, 496, and 501 from Prescott L. M., Harley J. P., Klein D.A. MICROBIOLOGY (McGraw-Hill Inc., 4th edition 1999) and pages 114, 118, 122, 181, 186, 190-92, 194-95, 197, 200 and 299 from TAXONOMIC OUTLINE OF THE PROKARYOTES BERGEY'S MANUAL OF SYSTEMIC BACTERIOLOGY, (2nd Edition 2004) (both references are cited on the IDS and submitted herewith for the Examiner's consideration).

Indeed, the specification provides thirteen representative bacterial species as working examples using the methods of the present invention to produce SRFs. Attention should be directed to Example 1, in particular Table 1, which provides that all thirteen bacterial species produced SRFs when stressed according to the invention. Example 6 demonstrates the effect of a fraction of less than <10kDa from a representative bacterial species (L. caseii) that activates macrophages.

The Examiner has provided no evidence to teach or suggest that this immunomodulatory effect observed from one bacterial species would not be expected from other species as well. The Examiner has not shown there would be any reason to doubt that other bacteria would not perform in the same way when stressed (produce SRFs) and immunomodulate the immune system of an animal when administered.

In light of the disclosure, the skilled microbiologist would be able to carry out the full scope of the claimed invention without undue experimentation. To the extent that the bacteria expressed SRFs modulate the immune response in an animal when administered, persons skilled in the art would able to determine whether a fraction of <10kDa produced according to the method of the present invention modulates the immune response in an animal. Therefore, exposing a bacteria to stress to generate/release SRFs and administering a fraction of <10kDa having SRFs to an animal is well within the knowledge and abilities of one skilled in the art. Therefore, the practice of this invention does not constitute undue experimentation.

In light of the foregoing remarks, it cannot be reasonably maintained that undue experimentation would be required to practice the invention. Applicant submits that they have satisfied the enablement requirement. Therefore, Applicant respectfully submits that claims 1, 4-

6, 8, 10-12 and 14-19 are in form for allowance and request that the rejection under 35 USC §112 be withdrawn and reconsidered.

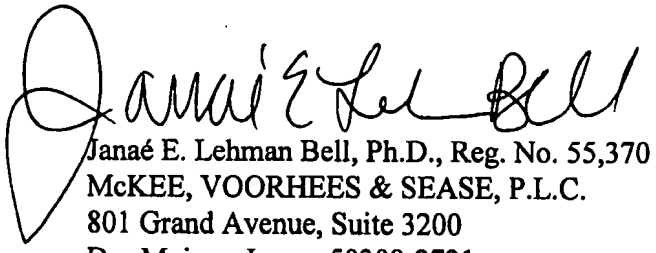
## IV. Conclusion

This is a request under the provision of 37 CFR § 1.136(a) to extend the period for filing a response in the above-identified application for one month from October 6, 2007 to November 6, 2007. Applicant is a small entity; therefore, please charge Deposit Account number 26-0084 in the amount of $60.00 to cover the cost of the one month extension. Any deficiency or overpayment should be charged or credited to Deposit Account 26-0084.

No other fees or extensions of time are believed to be due in connection with this amendment; however, consider this a request for any extension inadvertently omitted, and charge any additional fees to Deposit Account No. 26-0084.

Reconsideration and allowance is respectfully requested.

Respectfully submitted,



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# Microbiology

*fourth edition*

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**Table 19.9** Some Characteristic Differences between Gram-negative and Gram-positive Bacteria

| Property | Gram-negative Bacteria | Gram-positive Bacteria | Mycoplasmas |
|---|---|---|---|
| Cell wall | Gram-negative type wall with inner 2–7 nm peptidoglycan layer and outer membrane (7–8 nm thick) of lipid, protein, and lipopolysaccharide. (There may be a third outermost layer of protein.) | Gram-positive type wall with a homogeneous, thick cell wall (20–80 nm) composed mainly of peptidoglycan. Other polysaccharides and teichoic acids may be present. | Lack a cell wall and peptidoglycan precursors; enclosed by a plasma membrane |
| Cell shape | Spheres, ovals, straight or curved rods, helices or filaments; some have sheaths or capsules. | Spheres, rods, or filaments; may show true branching | Pleomorphic in shape; may be filamentous, can form branches |
| Reproduction | Binary fission, sometimes budding | Binary fission | Budding, fragmentation, and/or binary fission |
| Metabolism | Phototrophic, chemolithoautotrophic, or chemoorganoheterotrophic | Usually chemoorganoheterotrophic | Chemoorganoheterotrophic; most require cholesterol and long-chain fatty acids for growth. |
| Motility | Motile or nonmotile. Flagellation can be varied—polar, lophotrichous, peritrichous. Motility may also result from the use of axial filaments (spirochetes) or gliding motility. | Most often nonmotile; have peritrichous flagellation when motile | Usually nonmotile |
| Appendages | Can produce several types of appendages—pili and fimbriae, prosthecae, stalks | Usually lack appendages (may have spores on hyphae) | Lack appendages |
| Endospores | Cannot form endospores | Some groups can form endospores. | Cannot form endospores |

with the phenetically based classification of the first edition of *Bergey's Manual* shows considerable disagreement. Many phenetically defined taxa are not phylogenetically homogeneous and have members distributed among two or more different phylogenetic groups (at least as judged by 16S rRNA studies). Often characteristics given great weight or importance in *Bergey's Manual* do not appear to be phylogenetically significant. For example, photosynthetic bacteria are found in several different phylogenetic groups together with very closely related nonphotosynthetic bacteria. Thus it may not be appropriate to separate all photosynthetic bacteria from the nonphotosynthetic forms as has been done in *Bergey's Manual*. The mycoplasmas are placed in a separate division, *Mollicutes*, in *Bergey's Manual*, but rRNA studies show that they are closely related to gram-positive bacteria although they lack cell walls. *Chlamydia* currently is grouped with the rickettsias in section 9, whereas it appears to be related to the genus *Planctomyces*, which is in a quite separate group. Because rods, cocci, spirals, and other shapes are found scattered among many phylogenetic groups, these morphological variations do not appear to be useful indicators of relatedness.

Despite the uncertainties and problems with the classification in the current edition of *Bergey's Manual*, it is the most widely accepted and used system for the identification of bacteria (Box 19.1). Moreover, *Bergey's Manual* often does provide phylogenetically meaningful information.

## The Second Edition of *Bergey's Manual of Systematic Bacteriology*

There has been enormous progress in bacterial taxonomy since 1984, the year the first volume of *Bergey's Manual of Systematic Bacteriology* was published. The number of named species has doubled, and there are well over 170 newly described genera. In particular, the sequencing of rRNA, DNA, and proteins has made phylogenetic analysis of bacteria feasible. As a consequence, the second edition of *Bergey's Manual* will be largely phylogenetic rather than phenetic and thus quite different from the first edition. Although the new edition will not be available for some time, it is so important that its general features will be described here. Undoubtedly the details will change as work progresses, but the general organization of the new *Bergey's Manual* can be summarized.

The second edition will be published in five volumes. It will have more ecological information about individual taxa. The second edition will not group all the clinically important bacteria together as the first edition did. Instead, pathogenic species will be placed phylogenetically and thus scattered throughout the five volumes. The coverage of the five volumes is summarized below.

Volume 1—The *Archaea*, Cyanobacteria, Green Phototrophs, and Deeply Branching Genera
Volume 2—The Proteobacteria
Volume 3—The Low G + C Gram Positives
Volume 4—The High G + C Gram Positives

## "Official" Nomenclature Lists: A Letter from Bergey's*

On a number of occasions lately, the impression has been given that the status of a bacterial taxon in *Bergey's Manual of Systematic Bacteriology* or *Bergey's Manual of Determinative Bacteriology* is in some sense official. Similar impressions are frequently given about the status of names in the *Approved List of Bacterial Names* and in the Validation Lists of newly proposed names that appear regularly in the *International Journal of Systematic Bacteriology*. It is therefore important to clarify these matters.

There is no such thing as an official classification. *Bergey's Manual* is not "official"—it is merely the best consensus at the time, and although great care has always been taken to obtain a sound and balanced view, there are also always regions in which data are lacking or confusing, resulting in differing opinions and taxonomic instability. When *Bergey's Manual* disavows that it is an official classification, many bacteriologists may feel that the solid earth is trembling. But many areas are in fact reasonably well established. Yet taxonomy is partly a matter of judgment and opinion, as is all science, and until new information is available, different bacteriologists may legitimately hold different views. They cannot be forced to agree to any "official classification." It must be remembered that, as yet, we know only a small percentage of the bacterial species in nature. Advances in technique also reveal new lights on bacterial relationships. Thus we must expect that existing boundaries of groups will have to be redrawn in the future, and it is expected that molecular biology, in particular, will imply a good deal of change over the next few decades.

The position with the Approved Lists and the Validation Lists is rather similar. When bacteriologists agreed to make a new start in bacteriological nomenclature, they were faced with tens of thousands of names in the literature of the past. The great majority were useless, because, except for about 2,500 names, it was impossible to tell exactly what bacteria they referred to. These 2,500 were therefore retained in the Approved Lists. The names are only approved in the sense that they were approved for retention in the new bacteriological nomenclature. The remainder lost standing in the nomenclature, which means they do not have to be considered when proposing new bacterial names (although names can be individually revived for good cause under special provisions).

The new International Code of Nomenclature of Bacteria requires all new names to be validly published to gain standing in the nomenclature, either by being published in papers in the *International Journal of Systematic Bacteriology* or, if published elsewhere, by being announced in the Validation Lists. The names in the Validation Lists are therefore valid only in the sense of being validly published (and therefore they must be taken account of in bacterial nomenclature). The names do not have to be adopted in all circumstances; if users believe the scientific case for the new taxa and validly published names is not strong enough, they need not adopt the names. For example, *Helicobacter pylori* was immediately accepted as a replacement for *Campylobacter pylori* by the scientific community, whereas *Tatlockia micdadei* had not generally been accepted as a replacement for *Legionella micdadei*. Taxonomy remains a matter of scientific judgment and general agreement.

*From P. H. A. Sneath and D. J. Brenner, "Official" Nomenclature Lists in *ASM News*, 58(4):175, 1992. Copyright © by the American Society for Microbiology. Reprinted by permission.

Volume 5—The Planctomycetes, Spirochetes, Fibrobacters, Bacteroides and Fusobacteria (Volume 5 also will contain a section that updates descriptions and phylogenetic arrangements that have been revised since publication of volume 1.)

The second edition's five volumes will have a different organization than the first edition. The greatest change in organization of the volumes will be with respect to the gram-negative bacteria. The first edition places all gram-negative bacteria in two volumes. Volume 1 contains the gram-negative bacteria of general, medical or industrial importance; volume 3 describes the archaeobacteria, cyanobacteria, and remaining gram-negative groups. The second edition divides the gram-negative bacteria into three volumes, with volume 2 reserved for the proteobacteria. The two editions treat the gram-positive bacteria more similarly. Although volume 2 of the first edition does have some high G + C bacteria, much of its coverage is equivalent to the new volume 3. Volume 4 of the first edition describes the actinomycetes and is similar to volume 4 of the second edition (high G + C gram positives), although the new volume 4 will have broader coverage. For example, *Micrococcus* and *Corynebacterium* are in volume 2 of the first edition and will be in volume 4 of the second edition. Table 19.10 summarizes the organization of the second edition and indicates where the discussion of a particular group may be found in this textbook.

1. What characteristics are used to place bacteria in different sections of *Bergey's Manual*?
2. What are the major ways in which gram-negative and gram-positive bacteria differ? Distinguish mycoplasmas from other eubacteria.
3. Discuss some characteristics emphasized by *Bergey's Manual* that may not be phylogenetically significant.
4. Give several major ways in which the second edition of *Bergey's Manual* differs from the first edition.

## A Survey of Bacterial Pylogeny and Diversity

Before beginning a detailed introduction to bacterial diversity, it might be best to very briefly survey the major groups in the order they are discussed in the second edition of *Bergey's Manual*. This overview is meant only as a general survey of bacterial diversity. The second edition is divided into 30 sections, only

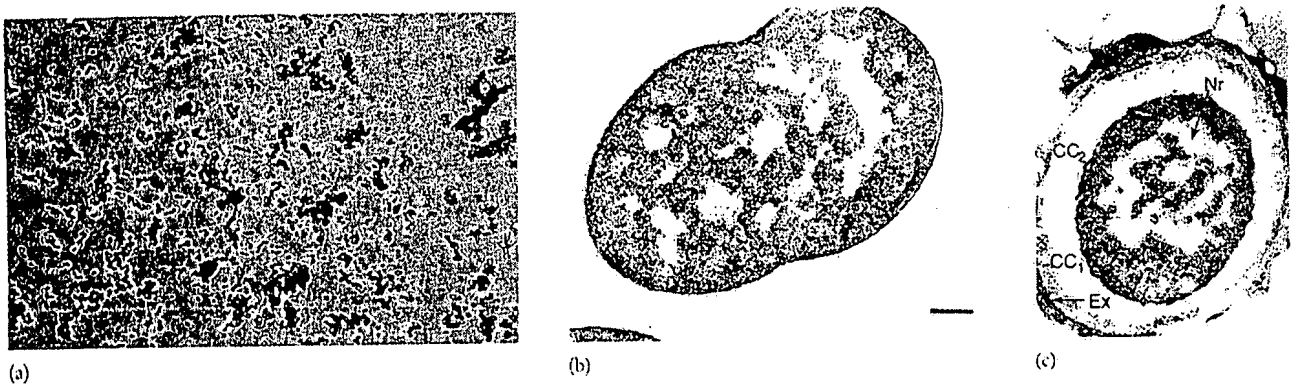


**Figure 22.24** *Azotobacter.* (*a*) *A. chroococcum* (×270). (*b*) Electron micrograph of *A. chroococcum.* Bar = 0.2 μm. (*c*) *Azotobacter* cyst structure. Bar = 0.2 μm. The nuclear region (Nr), exine layers ($CC_1$ and $CC_2$), and exosporium (Ex) are visible.

**Table 22.6 Characteristics of Families of Facultatively Anaerobic Gram-Negative Rods**

| Characteristics | *Enterobacteriaceae* | *Vibrionaceae* | *Pasteurellaceae* |
|---|---|---|---|
| Cell dimensions | 0.3–1.0 × 1.0–6.0 μm | 0.3–1.3 × 1.0–3.5 μm | 0.2–0.3 × 0.3–2.0 μm |
| Morphology | Straight rods; peritrichous flagella or nonmotile | Straight or curved rods; polar flagella | Coccoid to rod-shaped cells, sometimes pleomorphic; nonmotile |
| Physiology | Oxidase negative | Oxidase positive; all can use D-glucose as sole or principal carbon source | Oxidase positive; heme and/or NAD often required for growth; organic nitrogen source required |
| G + C content | 38–60% | 38–63% | 38–47% |
| Symbiotic relationships | Some parasitic on mammals and birds; some species plant pathogens | Most not pathogens (with a few exceptions) | Parasites of mammals and birds |
| Representative genera | *Escherichia, Shigella, Salmonella, Citrobacter, Klebsiella, Enterobacter, Erwinia, Serratia, Proteus, Yersinia* | *Vibrio, Photobacterium* | *Pasteurella, Haemophilus* |



The order *Vibrionales* contains only one family, the *Vibrionaceae*. Members of the family *Vibrionaceae* are gram-negative, straight or curved rods with polar flagella (figure 22.25). Most are oxidase positive, and all use D-glucose as their sole or primary carbon and energy source (see table 22.6). The majority are aquatic microorganisms, widespread in fresh water and the sea. There are six genera in the family: *Vibrio, Photobacterium, Enhydrobacter, Salinivibrio, Listonella,* and *Allomonas.*

Several vibrios are important pathogens. *V. cholerae* (*see figure 3.1*e) is the causative agent of cholera (*see chapter 37*), and *V. parahaemolyticus* sometimes causes gastroenteritis in humans following consumption of contaminated seafood. *V. anguillarum* and others are responsible for fish diseases.

Several members of the family are unusual in being bioluminescent. *Vibrio fischeri* and at least two species of *Photobacterium* are among the few marine bacteria capable of **bioluminescence** and emit a blue-green light because of the activity of the enzyme luciferase (Box 22.1). The peak emission of light is usually between 472 and 505 nm, but one strain of *V. fischeri* emits

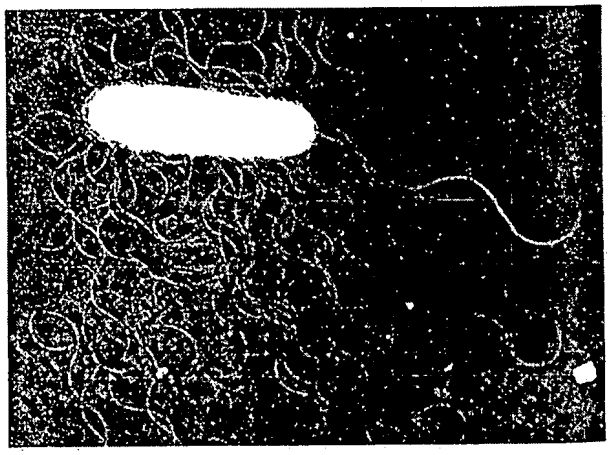

**Figure 22.25 The *Vibrionaceae*.** Electron micrograph of *Vibrio alginolyticus* grown on agar, showing a sheathed polar flagellum and unsheathed lateral flagella (×18,000).

of formic acid fermentation are distinguished by the methyl red and Voges-Proskauer tests.

Formic acid fermentation and the family Enterobacteriaceae (pp. 175–76).

Because the enteric bacteria are so similar in appearance, biochemical tests are normally used to identify them after a preliminary examination of their morphology, motility, and growth responses (figure 22.27 provides a simple example). Some more commonly used tests are those for the type of formic acid fermentation, lactose and citrate utilization, indole production from tryptophan, urea hydrolysis, and hydrogen sulfide production. For example, lactose fermentation occurs in *Escherichia* and *Enterobacter* but not in *Shigella, Salmonella,* or *Proteus.* Table 22.7 summarizes a few of the biochemical properties useful in

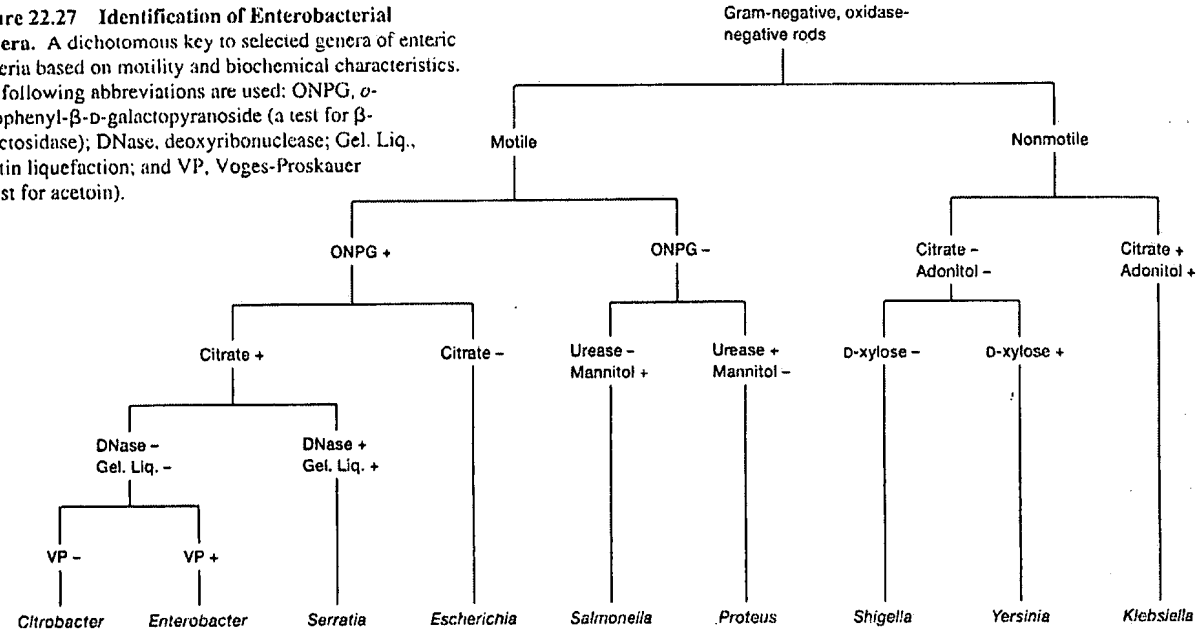


**Figure 22.27 Identification of Enterobacterial Genera.** A dichotomous key to selected genera of enteric bacteria based on motility and biochemical characteristics. The following abbreviations are used: ONPG, *o*-nitrophenyl-β-D-galactopyranoside (a test for β-galactosidase); DNase, deoxyribonuclease; Gel. Liq., gelatin liquefaction; and VP, Voges-Proskauer (a test for acetoin).

**Table 22.7 Some Characteristics of Selected Genera in the *Enterobacteriaceae***

| Characteristics | *Escherichia* | *Shigella* | *Salmonella* | *Citrobacter* | *Proteus* |
|---|---|---|---|---|---|
| Methyl red | + | + | + | + | + |
| Voges-Proskauer | – | – | – | – | d |
| Indole production | (+) | d | – | d | d |
| Citrate use | – | – | (+) | + | d |
| $H_2S$ production | – | – | (+) | d | (+) |
| Urease | – | – | – | (+) | + |
| β-galactosidase | (+) | d | d | + | – |
| Gas from glucose | + | – | (+) | + | + |
| Acid from lactose | + | – | (–) | d | – |
| Phenylalanine deaminase | – | – | – | – | + |
| Lysine decarboxylase | (+) | – | (+) | – | – |
| Ornithine decarboxylase | (+) | d | (+) | (+) | d |
| Motility | d | – | (+) | + | + |
| Gelatin liquifaction (22°C) | – | – | – | – | + |
| % G + C | 48–52 | 49–53 | 50–53 | 50–52 | 38–41 |
| Other characteristics | 1.1–1.5 × 2.0–6.0 μm; peritrichous when motile | No gas from sugars | 0.7–1.5 × 2–5 μm; peritrichous flagella | 1.0 × 2.0–6.0 μm; peritrichous | 0.4–0.8 × 1.0–3.0 μm; peritrichous |

[a](+) usually present

[b](–) usually absent

[c]d, strains or species vary in possession of characteristic

**Table 23.3 Characteristics of Bacilli and Lactobacilli**

| Genus | Dimensions (μm) and Morphology | G + C Content (mol%) | Oxygen Requirement | Other Distinctive Characteristics |
|---|---|---|---|---|
| *Bacillus* | 0.5–2.5 × 1.2–10; straight rods, peritrichous | 32–69 | Aerobic or facultative | Forms endospores; catalase positive; chemoorganotrophic |
| *Caryophanon* | 1.5–3.0 × 10–20; multicellular rods with rounded ends, peritrichous | 41–46 | Aerobic | Acetate only major carbon source; catalase positive; trichome cells have greater width than length, trichomes can be in short chains |
| *Enterococcus* | 0.6–2.0 × 0.6–2.5; spherical or ovoid cells in pairs or short chains, nonsporing, sometimes motile | 34–42 | Facultative | Ferments carbohydrates to lactate with no gas; complex nutritional requirements; catalase negative; occurs widely, particularly in fecal material |
| *Lactobacillus* | 0.5–1.2 × 1.0–10; usually long, regular rods, nonsporing, rarely motile | 32–53 | Facultative or microaerophilic | Fermentative, at least half the end-product is lactate; requires rich, complex media; catalase and cytochrome negative |
| *Lactococcus* | 0.5–1.2 × 0.5–1.5; spherical or ovoid cells in pairs or short chains, nonsporing, nonmotile | 38–40 | Facultative | Chemoorganotrophic with fermentative metabolism; lactate and no gas produced; catalase negative; complex nutritional requirements; in diary and plant products |
| *Leuconostoc* | 0.5–0.7 × 0.7–1.2; cells spherical or ovoid, in pairs or chains; nonmotile and nonsporing | 38–44 | Facultative | Requires fermentable carbohydrate and nutritionally rich medium for growth; fermentation produces lactate, ethanol, and gas; catalase and cytochrome negative |
| *Staphylococcus* | 0.9–1.3; spherical cells occurring singly and in irregular clusters, nonmotile and nonsporing | 30–39 | Facultative | Chemoorganotrophic with both respiratory and fermentative metabolism, usually catalase positive, associated with skin and mucous membranes of vertebrates |
| *Streptococcus* | 0.5–2.0; spherical or ovoid cells in pairs or chains, nonmotile and nonsporing | 34–46 | Facultative | Fermentative, producing mainly lactate and no gas; catalase negative; commonly attack red blood cells (α- or β-hemolysis); complex nutritional requirements; commensals or parasites on animals |
| *Thermoactinomyces* | 0.4–1.0 in diameter; branched, septate mycelium typical of actinomycetes | 52.0–54.8 | Aerobic | Usually thermophilic; true endospores form singly on hyphae; numerous in decaying hay, vegetable matter, and compost |

(a) (b)

**Figure 23.8** *Bacillus* (*a*) *B. anthracis*, spores elliptical and central (×1,600). (*b*) *B. subtilis*, spores elliptical and central.

were formerly in the genus *Bacillus* are *Paenibacillus alvei*, *P. macerans*, and *P. polymyxa*.

Many species of *Bacillus* are of considerable importance. For example, members of the genus *Bacillus* produce the antibiotics bacitracin, gramicidin, and polymyxin. *B. cereus* causes some forms of food poisoning and can infect humans. *B. anthracis* is the causative agent of the disease anthrax, which can affect both farm animals and humans (*see chapter 37*). Several species are used as insecticides. For example, *B. thuringiensis* and *B. sphaericus* form a solid pro-

**Table 23.4 Classification of the Streptococci, Enterococci, and Lactococci**

| Characteristics | *Streptococcus* | *Enterococcus* | *Lactococcus* |
|---|---|---|---|
| Predominant arrangement (most common first) | Chains, pairs | Pairs, chains | Pairs, short chains |
| Capsule/slime layer | + | – | – |
| Habitat | Mouth, respiratory tract | Gastrointestinal tract | Dairy products |
| Growth at 45°C | Variable | + | – |
| Growth at 10°C | Variable | Usually + | + |
| Growth at 6.5% NaCl broth | Variable | + | – |
| Growth at pH 9.6 | Variable | + | – |
| Hemolysis | Usually β (pyogenic) or α (oral) | α, β, – | Usually – |
| Serological group (Lancefield) | Variable (A–O) | Usually D | Usually N |
| Mol% G + C (normal range) | 34–46 | 34–42 | 38–40 |
| Representative species | Pyogenic streptococci<br>*S. agalactiae*<br>*S. pyogenes*<br>*S. equi*<br>*S. dysgalactiae* | *E. faecalis*<br>*E. faecium*<br>*E. avium*<br>*E. durans*<br>*E. gallinarum* | *L. lactis*<br>*L. raffinolactis*<br>*L. plantarum* |
| | Oral streptococci<br>*S. gordonii*<br>*S. salvarius*<br>*S. sanguis*<br>*S. oralis*<br>*S. pneumoniae*<br>*S. mitis*<br>*S. mutans* | | |
| | Other streptococci<br>*S. bovis*<br>*S. thermophilus* | | |

**Table 23.5 Properties of Selected Streptococci and Relatives**

| | Pyogenic Streptococci | Oral Streptococci | | | Enterococci | Lactic Acid Streptococci |
|---|---|---|---|---|---|---|
| Characteristics | *S. pyogenes* | *S. pneumoniae* | *S. sanguis* | *S. mutans* | *E. faecalis* | *L. lactis* |
| Growth at 10°C | –[a] | – | – | – | + | + |
| Growth at 45°C | – | – | d | d | + | – |
| Growth at 6.5% NaCl | – | – | – | – | + | – |
| Growth at pH 9.6 | – | – | – | – | + | – |
| Growth with 40% bile | – | – | d | d | + | + |
| α-hemolysis | – | + | + | – | – | d |
| β-hemolysis | + | – | – | – | + | – |
| Arginine hydrolysis | + | + | + | – | + | d |
| Hippurate hydrolysis | – | – | – | – | + | d |
| Mol% G + C of DNA | 35–39 | 30–39 | 40–46 | 36–38 | 34–38 | 39 |

Modified from *Bergey's Manual of Systematic Bacteriology*, Vol. 2, edited by P. H. A. Sneath, et al. Copyright © 1986 Williams and Wilkins, Baltimore, MD. Reprinted by permission.

[a] Symbols: +, 90% or more of strains positive; –, 10% or less of strains positive; d, 11–89% of strains are positive.

lactic acid, but no gas, as the major product—that is, they carry out homolactic fermentation (*see chapter 9*). A few species are anaerobic rather that facultative.

The genus *Streptococcus* is large and complex. The first edition of *Bergey's Manual* lists 38 species clustered in four groups; pyogenic streptococci, oral streptococci, anaerobic streptococci, and other streptococci. Many bacteria that were placed within the genus have been moved to two new genera. *Enterococcus* (18 species) and *Lactococcus* (8 species). In the second edition *Streptococcus* still has over 40 species. Some major characteristics of these three closely related genera are summarized in table 23.4. Table 23.5 lists a few properties of selected genera.

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# TAXONOMIC OUTLINE OF THE PROKARYOTES BERGEY'S MANUAL® OF SYSTEMATIC BACTERIOLOGY, SECOND EDITION

**Release 5.0 May 2004**

**George M. Garrity**
**Julia A. Bell**
**and Timothy G. Lilburn**

*Succinimonas amylolytica* [AL (T)] Bryant et al. 1958 - B24 | ATCC 19206 | DSM 2873, Y17599 | VPI 13846

*Order XIII. Enterobacteriales* [NP]

*Family I. Enterobacteriaceae* [AL]

*Genus I. Escherichia* [AL (T)]

*Escherichia coli* [AL (T)] (Migula 1895) Castellani and Chalmers 1919 , E.coli1775 - O1:K1:H7 | ATCC 11775, X80725 | CCM 5172 | CIP 54.8 | DSM 30083 | IAM 12119 | JCM 1649 | NCDO 1989 | NCTC 9001

†*Escherichia adecarboxylata* [AL] Leclerc 1962 -> *Leclercia adecarboxylata* - ATCC 23216 | DSM 30081

*Escherichia albertii* [VP] Huys et al. 2003 - Albert 19982 | CCUG 46494 | LMG 20976, AJ508775

*Escherichia blattae* [AL] Burgess et al. 1973 - ATCC 29907 | CDC 9005-74 | DSM 4481

*Escherichia fergusonii* [VP] Farmer et al. 1985 - ATCC 35469, AF530475 | CDC 0568-73

*Escherichia hermannii* [VP] Brenner et al. 1983 - ATCC 33650 | CDC 980-72 | DSM 4560

*Escherichia vulneris* [VP] Brenner et al. 1983 - ATCC 33821, X80734, E.vulneris | CDC 875-72 | DSM 4564 | IAM 14239 | JCM 1688 | NIH 580

*Genus II. Alterococcus* [VP]

*Alterococcus agarolyticus* [VP (T)] Shieh and Jean 1999 - ADT3, AF075271, Alt.agrlyt | CCRC 19135

*Genus III. Arsenophonus* [VP]

*Arsenophonus nasoniae* [VP (T)] Gherna et al. 1991 - SK14, M90801, Ars.nasoni | ATCC 49151, M90801, Ars.nasoni

"*Candidatus* Arsenophonus triatominarum" Hypsa and Dale 1997 U91786

*Genus IV. Brenneria* [VP]

*Brenneria salicis* [VP (T)] (Day 1924) Hauben et al. 1999 <- *Erwinia salicis* (basonym) - BS 1027 | EX2 | ATCC 15712, U80210, Bn.salicis | CFBP 802 | DSM 30166 | ICMP 1587 | LMG 2698, Z96097, Bn.salici2 | NCPPB 447

*Brenneria alni* [VP] (Surico et al. 1996) Hauben et al. 1999 <- *Erwinia alni* (basonym) - PVFi 20 | DSM 11811 | ICMP 12481, AJ223468, Bn.alni1 | NCPPB 3934

*Brenneria nigrifluens* [VP] (Wilson et al. 1957) Hauben et al. 1999 <- *Erwinia nigrifluens* (basonym) - EN 101 | ATCC 13028, U80203, Bn.nigrif1 | DSM 30175 | ICMP 1578 | LMG 2694, Z96095, Bn.nigrif2

*Brenneria paradisiaca* [VP] (Fernandez-Borrero and Lopez-Duque 1970) Hauben et al. 1999 <- *Erwinia paradisiaca* (basonym) - ATCC 33242 | LMG 2542, Z96096, Bn.paradis | NCPPB 2511

*Brenneria quercina* [VP] (Hildebrand and Schroth 1967) Hauben et al. 1999 <- *Erwinia quercina* (basonym) - ATCC 29281 | DSM 4561 | ICMP 1845 | ICPB EQ 101 | LMG 2724, AJ223469, Bn.quercin

*Brenneria rubrifaciens* [VP] (Wilson et al. 1967) Hauben et al. 1999 <- *Erwinia rubrifaciens* (basonym) - 533c | Dye FC1 | ATCC 29291, U80207, Bn.rubrifa | CFBP 1283 | DSM 4483 | ICMP 1915 | ICPB ER 103 | LMG 2709, Z96098, Bn.rubrif2 | NCPPB 2020 | PDDCC 1915

*Genus V. Buchnera* [VP]

*Buchnera aphidicola* [VP (T)] Munson et al. 1991 - no culture isolated, M63246, Buc.aphSgr

*Genus VI. Budvicia* [VP]

*Budvicia aquatica* [VP (T)] Bouvet et al. 1985 - 20186 | 20186HG01 | ATCC 25567 | CNCTC 350 | DSM 5075, AJ233407

*Genus VII. Buttiauxella* [VP]

*Buttiauxella agrestis* [VP (T)] Ferragut et al. 1982 emend. Müller et al. 1996 - Gavini F-44 | ATCC 33320 | CDC 1176-81, AJ293685 | CIP 80-31 | CUETM 77-167 | DSM 4586

*Buttiauxella brennerae* [VP] Müller et al. 1996 - S1/6-571 | ATCC 51605 | DSM 9396, AJ233401

*Buttiauxella ferragutiae* [VP] Müller et al. 1996 - ATCC 51602|CDC 1180-81|CUETM 78-31|DSM 9390, AJ233402

*Buttiauxella gaviniae* [VP] Müller et al. 1996 - S1/1-984|ATCC 51604|DSM 9393, AJ233403

*Buttiauxella izardii* [VP] Müller et al. 1996 - S3/2-161|ATCC 51606|DSM 9397, AJ233404

*Buttiauxella noackiae* [VP] Müller et al. 1996 - NSW 11, AJ293689|ATCC 51607|DSM 9401, AJ233405

*Buttiauxella warmboldiae* [VP] Müller et al. 1996 - NSW 326|ATCC 51608|DSM 9404, AJ233406

*Genus VIII. Calymmatobacterium* [VP]

†*Calymmatobacterium granulomatis* [AL (T)] Aragao and Vianna 1913 -> *Klebsiella granulomatis*, AF010251, Cmb.granu1, AF010252, Cmb.granu2, AF010253, Cmb.granu3

*Genus IX. Cedecea* [VP]

*Cedecea davisae* [VP (T)] Grimont et al. 1981 - 5|ATCC 33431|CDC 3278-77|CIP 80.34|DSM 4568, AF493976

*Cedecea lapagei* [VP] Grimont et al. 1981 - 4|ATCC 33432|CDC 0485-76|CIP 80.35

*Cedecea neteri* [VP] Farmer et al. 1983 - 002 of Grimont|ATCC 33855|CDC 0621-75

*Genus X. Citrobacter* [AL]

*Citrobacter freundii* [AL (T)] (Braak 1928) Werkman and Gillen 1932 - ATCC 8090|DSM 30039, AJ233408|NBRC 12681|NCTC 9750

*Citrobacter amalonaticus* [VP] (Young et al. 1971) Brenner and Farmer 1982 <- *Levinea amalonatica* (basonym) - ATCC 25405aeCIP 82.89|DSM 4593|NCTC 10805

*Citrobacter braakii* [VP] Brenner et al. 1993 - ATCC 51113|CDC 80-58, AF025368, Cit.braaki

*Citrobacter diversus* (Burkey 1928) Werkman and Gillen 1932 *nom. rej.* [272] = *Citrobacter koseri* (senior heterotypic synonym) - ATCC 27156|CDC 3613-63, AF025372, Cit.koseri|CIP 82.94|DSM 4570

*Citrobacter farmeri* [VP] Brenner et al. 1993 - ATCC 51112|CDC 2991-81, AF025371, Cit.farmer

*Citrobacter gillenii* [VP] Brenner et al. 2000 - ATCC 51117|CCUG 30796|CDC 4693-86

*Citrobacter koseri* [AL] Frederiksen 1970 = *Levinea malonatica* (junior heterotypic synonym) = *Citrobacter diversus* (junior heterotypic synonym) - ATCC 27028|CCM 2537|CDC 3613-63, AF025372|CIP 82.87|DSM 4595|NCTC 10786

*Citrobacter murliniae* [VP] Brenner et al. 1999 - ATCC 51118|CCUG 30797|CDC 2970-59, AF025369

*Citrobacter rodentium* [VP] Schauer et al. 1996 - ATCC 51116|CDC 1843-73, AF025363, Cit.rodent

*Citrobacter sedlakii* [VP] Brenner et al. 1993 - ATCC 51115|CDC 4696-86, AF025364, Cit.sedlak

*Citrobacter werkmanii* [VP] Brenner et al. 1993 - ATCC 51114|CDC 876-58, AF025373, Cit.werkma

*Citrobacter youngae* [VP] Brenner et al. 1993 - ATCC 29935|CDC 460-61

*Genus XI. Edwardsiella* [AL]

*Edwardsiella tarda* [AL (T)] Ewing and McWhorter 1965 - K349|ATCC 15947, AB050827|ATCC 23656|CCM 2238|CDC 1483-59|DSM 30052|NCDC 1483-59|NCTC 10396

*Edwardsiella anguillimortifera* [AL] (Hoshina 1962) Sakazaki and Tamura 1975 - ATCC 15947

*Edwardsiella hoshinae* [VP] Grimont et al. 1981 - 28522|ATCC 33379|CIP 78.56|JCM 1679, AB050825

*Edwardsiella ictaluri* [VP] Hawke et al. 1981 - ATCC 33202|CDC 1976-78|JCM 1680, AB050826|SECFDL GA77-52

[272] *Citrobacter diversus* was included in the Approved List of Bacterial Names but has since been placed on the list of *nomina rejicienda*.

*Genus XII. Enterobacter* [AL]

*Enterobacter cloacae* [AL (T)] (Jordan 1890) Hormaeche and Edwards 1960 - ATCC 13047, AJ251469 | CIP 60.85 | DSM 30054 | NBRC 13535 | NCDC 279-56 | NCTC 10005

*Enterobacter aerogenes* [AL] Hormaeche and Edwards 1960 = *Klebsiella mobilis* (homotypic synonym) - ATCC 13048 | CDC 819-56 | DSM 30053 | JCM 1235, AB004750, Enb.aeroge | NCTC 10006

†*Enterobacter agglomerans* [AL] Ewing and Fife 1972 -> *Pantoea agglomerans* = *Erwinia herbicola* (junior heterotypic synonym) = *Erwinia milletiae* (junior heterotypic synonym) - ATCC 27155 | CIP 57.51 | DSM 3493 | JCM 1236, AB004691, Pn.agglomr | NCTC 9381

*Enterobacter amnigenus* [VP] Izard et al. 1981 - ATCC 33072 | CUETM 77-118 | DSM 4486 | JCM 1237, AB004749, Enb.amnige

*Enterobacter asburiae* [VP] Brenner et al. 1988 - 1497-78 | ATCC 35953 | CDC 1497-78 | JCM 6051, AB004744, Enb.asburi

*Enterobacter cancerogenus* [VP] (Urosevic 1966) Dickey and Zumoff 1988 <- *Erwinia cancerogena* (basonym) = *Enterobacter taylorae* (junior heterotypic synonym) - ATCC 33241 | ICMP 5706 | LMG 2693, Z96078, Enb.cancer | NCPPB 2176

*Enterobacter cowanii* [VP] Inoue et al. 2001 [273] - 888–76 | CIP 107300, AJ508303 | JCM 10956

*Enterobacter dissolvens* [VP] (Rosen 1922) Brenner et al. 1988 <- *Erwinia dissolvens* (basonym) - ATCC 23373 | ICMP 1570 | LMG 2683, Z96079, Enb.dissol | NCPPB 1850

*Enterobacter gergoviae* [VP] Brenner et al. 1980 - ATCC 33028 | CDC 604-77 | CIP 76.01 | DSM 9245 | JCM 1234, AB004748, Enb.gergov | NCTC 11434

*Enterobacter hormaechei* [VP] O'Hara et al. 1990 - 0992-77 | ATCC 49162 | CIP 103441, AJ508302 | DSM 12409

*Enterobacter intermedius* [VP] Izard et al. 1980 - E86 | Gavini E 86 | ATCC 33110 | CIP 79-27 | CUETM 77-130 | DSM 4581 | IAM 14238 | JCM 1238, AB004747, Enb.interm

*Enterobacter kobei* [VP] Kosako et al. 1997 - CIP 105566, AJ508301 | JCM 8580 | NIH 1485-79

*Enterobacter nimipressuralis* [VP] (Carter 1945) Brenner et al. 1988 <- *Erwinia nimipressuralis* (basonym) - ATCC 9912 | ICMP 1577 | LMG 10245, Z96077, Enb.nimipr

*Enterobacter pyrinus* [VP] Chung et al. 1993 - ATCC 49851 | CDC G6570 | DSM 12410 | ICMP 1 | KCTC 2520, AJ010486, Enb.pyrinu

*Enterobacter sakazakii* [VP] Farmer et al. 1980 - Ct2 | ATCC 29544 | CDC 4562-70 | DSM 4485 | JCM 1233, AB004746, Enb.sakaza

†*Enterobacter taylorae* [VP] Farmer et al. 1985 = *Enterobacter cancerogenus* (senior heterotypic synonym) - ATCC 35317 | CDC 2126-81

*Genus XIII. Erwinia* [AL]

*Erwinia amylovora* [AL (T)] (Burrill 1882) Winslow et al. 1920 emend. Hauben et al. 1998 - ATCC 15580, U80195, Er.amylovr | ATCC 15580 | CCM 1114 | CFBP 1232 | DSM 30165 | ICMP 1540 | NBRC 12687 | LMG 2024, Z96088, Er.amylov2 | NCPPB 683 | PDDCC 1540

†*Erwinia alni* [VP] Surico et al. 1996 -> *Brenneria alni* - PVFi 20 | DSM 11811 | ICMP 12481, AJ223468, Bn.alni1 | NCPPB 3934

†*Erwinia ananatis* [AL] Serrano 1928 = *Erwinia uredovora* (junior heterotypic synonym) -> *Pantoea ananatis* - ATCC 11530 | DSM 30070 | NCPPB 1846

*Erwinia aphidicola* [VP] Harada et al. 1998 - X 001 | IAM 14479

*Erwinia billingiae* [VP] Mergaert et al. 1999 - Billing E63 | LMG 2613, Y13249, Er.billingi | NCPPB 661

†*Erwinia cacticida* [VP] Alcorn et al. 1991 -> *Pectobacterium cacticida* - 1 12 | ATCC 49481 | ICMP 1551-66 | ICPB EC1

†*Erwinia cancerogena* [AL] Urosevic 1966 -> *Enterobacter cancerogenus* - NCPPB 2176

[273] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

*Erwinia carnegieana* [AL] Standring 1942 <- *Pectobacterium carnegieana* (basonym) - NCPPB 439

†*Erwinia carotovora subsp. carotovora* [AL] (Jones 1901) Bergey et al. 1923 -> *Pectobacterium carotovorum subsp. carotovorum* - BS 1008|ATCC 15713, U80197, Pcb.carcar|CCM 1008|CCUG 4907|CECT 225|CIP 82.83|DSM 30168|LMG 2404, Z96089, Pcb.carca2|M59149|NCPPB 312

†*Erwinia carotovora subsp. atroseptica* [AL] (van Hall 1902) Dye 1969 -> *Pectobacterium carotovorum subsp. atrosepticum* - ATCC 33260|CFBP 1526|LMG 2386, Z96090, Pcb.caratr|NCPPB 549

†*Erwinia carotovora subsp. betavasculorum* [VP] Thomson et al. 1984 -> *Pectobacterium carotovorum subsp. betavasculorum* - ATCC 43762, U80198, Pcb.carbe2|CFBP 1539|LMG 2466, Z96091, Pcb.carbet|NCPPB 2795

†*Erwinia carotovora subsp. odorifera* [VP] Gallois et al. 1992 -> *Pectobacterium carotovorum subsp. odoriferum* - CFBP 1878, AF373191|ICMP 11533|NCPPB 3839

†*Erwinia carotovora subsp. wasabiae* [VP] Goto and Mazumoto 1987 -> *Pectobacterium carotovorum subsp. wasabiae* - SR91|ATCC 43316, U80199, Pcb.carwas|LMG 8444|PDDCC 9121

†*Erwinia chrysanthemi* [AL] Burkholder et al. 1953 -> *Pectobacterium chrysanthemi* - EC17|ATCC 11663, U80200, Pcb.chrysn|CFBP 2048|CIP 82.99|DAR 35625|DSM 4610|ICMP 5703|LMG 2804, Z96093, Pcb.chrys2|NCPPB 402|PDDCC 5703

*Erwinia cypripedii* [AL] (Hori 1911) Bergey et al. 1923 = *Pectobacterium cypripedii* (homotypic synonym) - ATCC 29267, U80201, Pcb.cyprip|DSM 3873|LMG 2657, Z96094, Pcb.cypri2|NCPPB 3994|PDDCC 1591

†*Erwinia dissolvens* [AL] (Rosen 1922) Burkholder 1948 -> *Enterobacter dissolvens* - ATCC 23373

†*Erwinia herbicola* [AL] (Lohnis 1911) Dye 1964 = *Enterobacter agglomerans* (senior heterotypic synonym) - ATCC 33243, U80202, Pn.agglom3|CIP 82.100|DSM 4609|ICMP 272|NCPPB 2971

*Erwinia mallotivora* [AL] Goto 1976 emend. Hauben et al. 1998 - AM1|ATCC 29573|CFBP 2503|DSM 4565|ICMP 5705|LMG 2708, Z96084, Er.mallotv|NCPPB 2851|PDDCC 5705

†*Erwinia milletiae* [AL] (Kawakami and Yoshida 1920) Magrou 1937 = *Enterobacter agglomerans* (senior heterotypic synonym) - ATCC 33261, U80183, Pn.agglom2|NCPPB 2519

†*Erwinia nigrifluens* [AL] Wilson et al. 1957 -> *Brenneria nigrifluens* - EN 101|ATCC 13028, U80203, Bn.nigrif1|DSM 30175|ICMP 1578|LMG 2694, Z96095, Bn.nigrif2

†*Erwinia nimipressuralis* [AL] (Carter 1945) Dye 1969 -> *Enterobacter nimipressuralis* - ATCC 9912

†*Erwinia paradisiaca* [AL] Fernandez-Borrero and Lopez-Duque 1970 -> *Brenneria paradisiaca* - ATCC 33242|LMG 2542, Z96096, Bn.paradis|NCPPB 2511

*Erwinia persicina* [VP] Hao et al. 1990 - AJ 2716|HK 204|ATCC 35998, U80205, Er.persici|CDC 9108-82|IAM 12843|JCM 3704

*Erwinia psidii* [VP] Neto et al. 1988 - ATCC 49406|IBSBF 435|PDDCC 8426

*Erwinia pyrifoliae* [VP] Kim et al. 1999 - Ep16/96|CFBP 4172|DSM 12163

†*Erwinia quercina* [AL] Hildebrand and Schroth 1967 -> *Brenneria quercina* - ATCC 29281|DSM 4561|ICMP 1845|ICPB EQ 101|LMG 2724, AJ223469, Bn.quercin

*Erwinia rhapontici* [AL] (Millard 1924) Burkholder 1948 emend. Hauben et al. 1998 <- *Pectobacterium rhapontici* (basonym) - CP/28|ATCC 29283, U80206, Er.rhapont|DSM 4484|ICMP 1582|ICPB ER 102|LMG 2688, Z96087, Er.rhapon2|NCPPB 1578

†*Erwinia rubrifaciens* [AL] Wilson et al. 1967 -> *Brenneria rubrifaciens* - 533c|Dye FC1|ATCC 29291, U80207, Bn.rubrifa|CFBP 1283|DSM 4483|ICMP 1915|ICPB ER 103|LMG 2709, Z96098, Bn.rubrif2|NCPPB 2020|PDDCC 1915

†*Erwinia salicis* [AL] (Day 1924) Chester 1939 -> *Brenneria salicis* - BS 1027 | EX2 | ATCC 15712, U80210, Bn.salicis | CFBP 802 | DSM 30166 | ICMP 1587 | LMG 2698, Z96097, Bn.salici2 | NCPPB 447

†*Erwinia stewartii* [AL] (Smith 1898) Dye 1963 -> *Pantoea stewartii subsp. stewartii* - SS11 | ATCC 8199, U80208, Pn.stewstw | DSM 30176 | IMET 11187

*Erwinia tracheiphila* [AL] (Smith 1895) Bergey et al. 1923 emend. Hauben et al. 1998 - ATCC 33245 | CFBP 2355 | LMG 2906, Y13250, Y13250, Er.trachep | NCPPB 2452

†*Erwinia uredovora* [AL] (Pon et al. 1954) Dye 1963 = *Erwinia ananatis* (senior heterotypic synonym) - ATCC 19321, U80209, Pn.ananas1 | DSM 30080 | NCPPB 800

*Genus XIV. Ewingella* [VP]

*Ewingella americana* [VP] [T] Grimont et al. 1984 - ATCC 33852 | CCUG 14506 | CDC 1468-78 | CIP 81.94 | CIP 8194 | DSM 4580 | JCM 5911 | LMG 7869

*Genus XV. Hafnia* [AL]

*Hafnia alvei* [AL] [T] Moller 1954 - ATCC 13337, M59155, Haf.alvei | CIP 57.31 | DSM 30163 | NCDC 434-68 | NCTC 8105

*Genus XVI. Klebsiella* [AL]

*Klebsiella pneumoniae subsp. pneumoniae* [AL] [T] (Schroeter 1886) Trevisan 1887 - Serovar 3 | ATCC 13883, Y17656, K.pneupneu | DSM 30104, X87276, K.pneumoni | IAM 14200 | JCM 1662, AB004753, K.pneumon4 | NCDC 298-53 | NCTC 9633

*Klebsiella pneumoniae subsp. ozaenae* [VP] (Abel 1893) Oerskov 1984 <- *Klebsiella ozaenae* (basonym) - ATCC 11296, Y17654, K.pneuozae | NCTC 5050

*Klebsiella pneumoniae subsp. rhinoscleromatis* [VP] (Trevisan 1887) Oerskov 1984 <- *Klebsiella rhinoscleromatis* (basonym) - ATCC 13884, Y17657, K.pneurhin | NCTC 5046

*Klebsiella granulomatis* [VP] (Aragão and Vianna 1913) Carter et al. 1999 <- *Calymmatobacterium granulomatis* (basonym) - no strain extant, AF009171, AF010251, AF010252, AF010253

*Klebsiella mobilis* [AL] Bascomb et al. 1971 = *Enterobacter aerogenes* (homotypic synonym) - ATCC 13048

†*Klebsiella ornithinolytica* [VP] Sakazaki et al. 1989 [274] -> *Raoultella ornithinolytica* - DSM 7464 | JCM 6096, AJ251467 | NIH 90-72

*Klebsiella oxytoca* [AL] (Flügge 1886) Lautrop 1956 - 479-2 | ATCC 13182, Y17655, K.oxytoca2 | DSM 5175 | IAM 14201 | JCM 1665, AB004754, K.oxytoca1

†*Klebsiella ozaenae* [AL] (Abel 1893) Bergey et al. 1925 -> *Klebsiella pneumoniae subsp. ozaenae* - ATCC 11296, Y17654, K.pneuozae

†*Klebsiella planticola* [VP] Bagley et al. 1982 [275] = *Klebsiella trevisanii* (junior heterotypic synonym) -> *Raoultella planticola* -> - V-236 | ATCC 33531, Y17659, K.plantic4 | CDC 4245-72 | DSM 3069, X93215, K.plantico | IAM 14202 | NBRC 14939 | JCM 7251, AB004755, K.plantic3

†*Klebsiella rhinoscleromatis* [AL] Trevisan 1887 -> *Klebsiella pneumoniae subsp. rhinoscleromatis* - ATCC 13884, Y17657, K.pneurhin

†*Klebsiella terrigena* [VP] Izard et al. 1981 [276] -> *Raoultella terrigena* - Gavini L 84 | ATCC 33257, Y17658, K.terrigen | CIP 80-07 | CUETM 77-176 | DSM 2687

†*Klebsiella trevisanii* [VP] Ferragut et al. 1983 = *Klebsiella planticola* (senior heterotypic synonym) - Gavini K70 | ATCC 33558, AF129444 | CIP 81-36 | CUETM 78-120 | DSM 2688

*Genus XVII. Kluyvera* [VP]

*Kluyvera ascorbata* [VP] [T] Farmer et al. 1981 - ATCC 33433, AF310219, AF008579 | CDC 0648-74, AF176560 | CIP 82.95 | DSM 4611 | IAM 14203

[274] Grimont indicates that the transfer of *Klebsiella ornithinolytica*, *K. planticola* and *K. terrigena* to *Raoultella* is not supported in phylogenetic trees based on *rpoB*.

[275] Grimont indicates that the transfer of *Klebsiella ornithinolytica*, *K. planticola* and *K. terrigena* to *Raoultella* is not supported in phylogenetic trees based on *rpoB*.

[276] Grimont indicates that the transfer of *Klebsiella ornithinolytica*, *K. planticola* and *K. terrigena* to *Raoultella* is not supported in phylogenetic trees based on *rpoB*.

*Kluyvera cochleae* [VP] Müller et al. 1996 - S3/1-49 | ATCC 51609, AF047187, Klu.cochle | DSM 9406

*Kluyvera cryocrescens* [VP] Farmer et al. 1981 - ATCC 33435, AF310218 | CDC 2065-78 | CIP 82.96 | DSM 4588 | IAM 14204

*Kluyvera georgiana* [VP] Müller et al. 1996 - ATCC 51603, AF047186, Klu.georgi | CDC 2891-76 | CDC enteric group 36/37 | DSM 9409

*Genus XVIII. Leclercia* [VP]

*Leclercia adecarboxylata* [VP (T)] (Leclerc 1962) Tamura et al. 1987 <- *Escherichia adecarboxylata* (basonym) - ATCC 23216 | DSM 5077 | IAM 14240 | JCM 1667

*Genus XIX. Leminorella* [VP]

*Leminorella grimontii* [VP (T)] Hickman-Brenner et al. 1985 - 81H-380 | ATCC 33999 | CDC 1944-81 | DSM 5078, AJ233421

*Leminorella richardii* [VP] Hickman-Brenner et al. 1985 - ATCC 33998 | CDC 0978-82

*Genus XX. Moellerella* [VP]

*Moellerella wisconsensis* [VP (T)] Hickman-Brenner et al. 1984 - 2896-78 | ATCC 35017 | DSM 5076

*Genus XXI. Morganella* [AL]

*Morganella morganii subsp. morganii* [AL (T)] (Winslow et al. 1919) Fulton 1943 = *Proteus morganii* (homotypic synonym) - M 11 | ATCC 25830 | CIP A231, AJ301681 | DSM 30164 | JCM 1672, AB089243 | NBRC 3848 | NCIB 235 | NCTC 235

*Morganella morganii subsp. sibonii* [VP] Jensen et al. 1992 - 8103-85 | AB 2048 | ATCC 49948

*Genus XXII. Obesumbacterium* [AL]

*Obesumbacterium proteus* [AL (T)] Shimwell 1963 - 42 | ATCC 12841 | DSM 2777, AJ233422 | NCIB 8771

*Genus XXIII. Pantoea* [VP]

*Pantoea agglomerans* [VP (T)] (Ewing and Fife 1972) Gavini et al. 1989 <- *Enterobacter agglomerans* (basonym) - ATCC 27155 | CDC 1461-67 | DSM 3493 | ICPB 3435 | JCM 1236, AB004691, Pn.agglomr | LMG 1286 | NCTC 9381

*Pantoea ananatis* [VP] (Serrano 1928) Mergaert et al. 1993 <- *Erwinia ananatis* (basonym) - ATCC 33244, U80196, Pn.ananat2 | LMG 2665, Z96081, Pn.ananati | NCPPB 1846 | PDDCC 1850

*Pantoea citrea* [VP] Kageyama et al. 1992 - SHS 2003 | ATCC 31623

*Pantoea dispersa* [VP] Gavini et al. 1989 - ATCC 14589 | DSM 30073 | LMG 2603

*Pantoea punctata* [VP] Kageyama et al. 1992 - SHS 2006 | ATCC 31626

*Pantoea stewartii subsp. stewartii* [VP] (Smith 1898) Mergaert et al. 1993 <- *Erwinia stewartii* (basonym) - ATCC 8199 | DSM 30176 | IMET 11187 | LMG 2715, Z96080, Pn.stewst2

*Pantoea stewartii subsp. indologenes* [VP] Mergaert et al. 1993 - ICMP 77 | LMG 2632, Y13251, Pn.stewind | NCPPB 2280

*Pantoea terrea* [VP] Kageyama et al. 1992 - SHS 2008 | ATCC 31628

*Genus XXIV. Pectobacterium* [AL]

*Pectobacterium carotovorum subsp. carotovorum* [VP (T)] (Jones 1901) Hauben et al. 1999 <- *Erwinia carotovora subsp. carotovora* (basonym) - 904 | BS 1008 | ATCC 15713, U80197, Pcb.carcar | CCM 1008 | DSM 30168 | LMG 2404, Z96089, Pcb.carca2 | NCPPB 312

†*Pectobacterium carotovorum subsp. atrosepticum* [VP] (van Hall 1902) Hauben et al. 1999 <- *Erwinia carotovora subsp. atroseptica* (basonym) -> *Pectobacterium atrosepticum* - ATCC 33260 | LMG 2386, Z96090, Pcb.caratr | NCPPB 549

†*Pectobacterium carotovorum subsp. betavasculorum* [VP] (Thomson et al. 1984) Hauben et al. 1999 <- *Erwinia carotovora subsp. betavasculorum* (basonym) -> *Pectobacterium betavasculorum* - ATCC 43762, U80198, Pcb.carbe2 | CFBP 1539 | LMG 2464, Z96091, Pcb.carbet | NCPPB 2795

*Pectobacterium carotovorum subsp. odoriferum* [VP] (Gallois et al. 1992) Hauben et al. 1999 <- *Erwinia carotovora subsp. odorifera* (basonym) - CFBP 1878 | LMG 17566, AJ223407, Pcb.carodo

*†Pectobacterium carotovorum subsp. wasabiae* [VP] (Goto and Mazumoto 1987) Hauben et al. 1999 <- *Erwinia carotovora subsp. wasabiae* (basonym) -> *Pectobacterium wasabiae* - SR 91 | ATCC 43316, U80199, Pcb.carwas | ICMP 9121, AJ223408 | PDDCC 9121

*Pectobacterium atrosepticum* [VP] (van Hall 1902) Gardan et al. 2003 <- *Pectobacterium carotovorum subsp. atrosepticum* (basonym) - CFBP 1526 | ICMP 1526, Z96090 | LMG 2386 | NCPPB 549

*Pectobacterium betavasulorum* [VP] (Thomson et al. 1984) Gardan et al. 2003 <- *Pectobacterium carotovorum subsp. betavasculorum* (basonym) - ATCC 43762, U80198 | CFBP 2122 | ICMP 4226 | LMG 2466, Z96091 | NCPPB 2795

*Pectobacterium cacticida* [VP] (Alcorn et al. 1991) Hauben et al. 1999 <- *Erwinia cacticida* (basonym) - 1 12 | ATCC 49481, AJ223409 | ICPB EC186 | LMG 17936

*†Pectobacterium carnegieana* [AL] (Standring 1942) Brenner et al. 1973 -> *Erwinia carnegieana* - NCPPB 439

*Pectobacterium chrysanthemi* [AL] (Burkholder et al. 1953) Brenner et al. 1973 emend. Hauben et al. 1998 = *Erwinia chrysanthemi* (homotypic synonym) - ATCC 11663, U80200, Pcb.chrysn | CIP 82.99 | DAR 35625 | DSM 4610 | EC17 | LMG 2804, Z96093, Pcb.chrys2 | NCPPB 402 | PDDCC 5703

*Pectobacterium cypripedii* [AL] (Hori 1911) Brenner et al. 1973 emend. Hauben et al. 1998 = *Erwinia cypripedii* (homotypic synonym) - ATCC 29267, U80201, Pcb.cyprip | DSM 3873 | ICMP 1591 | LMG 2657, Z96094, Pcb.cypri2 | NCPPB 3994 | PDDCC 1591

*†Pectobacterium rhapontici* [AL] (Millard 1924) Patel and Kulkarni 1951 -> *Erwinia rhapontici* - CP/28 | ATCC 29283, U80206, Er.rhapont | DSM 4484 | ICMP 1582 | ICPB ER 102 | LMG 2688, Z96087, Er.rhapon2 | NCPPB 1578

*Pectobacterium wasabiae* [VP] (Goto and Mazumoto 1987) Gardan et al. 2003 <- *Erwinia carotovora subsp. wasabiae* (basonym) - SR 91 | ATCC 43316, U80199 | CFBP 3304 | ICMP 9121, AJ223408 | LMG 8404 | NCPPB 3701 | PDDCC 9121

*Genus XXV. "Phlomobacter"*

"*Candidatus* Phlomobacter fragariae" U91515

*Genus XXVI. Photorhabdus* [VP]

*Photorhabdus luminescens subsp. luminescens* [VP (T)] (Thomas and Poinar 1979) Boemare et al. 1993 <- *Xenorhabdus luminescens* (basonym) - Hb | ATCC 29999, D78005, Pr.lumine4 | DSM 3368, X82248, Pr.lumines

*Photorhabdus luminescens subsp. akhurstii* [VP] Fischer-Le Saux et al. 1999 - FRG04 | CIP 105564, AJ007359

*Photorhabdus luminescens subsp. laumondii* [VP] Fischer-Le Saux et al. 1999 - TT01 | CIP 105565, AJ007404

*Phororhabdus asymbiotica* [VP] Fischer-Le Saux et al. 1999 - 3265-86, Z76755 | ATCC 43950

*Photorhabdus temperata* [VP] Fischer-Le Saux et al. 1999 - XINach | CIP 105563, AJ007405

*Genus XXVII. Plesiomonas* [AL]

*Plesiomonas shigelloides* [AL (T)] (Bader 1954) Habs and Schubert 1962 - M51 | RH 798 | ATCC 14029, M59159, Ple.shigel | ATCC 14029, X74688, Ple.shige4 | CDC 3085-55 | DSM 8224 | NCIB 9242

*Genus XXVIII. Pragia* [VP]

*Pragia fontium* [VP (T)] Aldova et al. 1988 - HG16 | CCUG 180 | CDC 963-84 | CNCTC Eb11/82 | DRL 20125 | DSM 5563, AJ233424

*Genus XXIX. Proteus* [AL]

*Proteus vulgaris* [AL (T)] Hauser 1885 - ATCC 13315 | DSM 30118, AJ233425 | NBRC 3851 | NCIB 4175

*Proteus hauseri* [VP] O'Hara et al. 2000 - ATCC 700826 | CDC 1732-80

*Proteus inconstans* [AL] (Orstein 1920) Shaw and Clarke 1955 - ATCC 9886

*Proteus mirabilis* [AL] Hauser 1885 - ATCC 29906, AF008582 | CDC PR 14 | DSM 4479 | NCTC 11938

*Proteus morganii* [AL] (Winslow et al. 1919) Yale 1939 = *Morganella morganii* (homotypic synonym) - ATCC 25830 | DSM 30164 | NBRC 3848 | NCIB 235 | NCTC 235

*Proteus myxofaciens* [AL] Cosenza and Podgwaite 1966 - ATCC 19692 | DSM 4482

*Proteus penneri* [VP] Hickman et al. 1983 - ATCC 33519 | CDC 1808-73 | DSM 4544

*Proteus rettgeri* [AL] (Hadley et al. 1918) Rustigian and Stuart 1943 = *Providencia rettgeri* (homotypic synonym) - Biovar 2a | ATCC 29944 | DSM 4542

*Genus XXX. Providencia* [AL]

*Providencia alcalifaciens* [AL (T)] (de Salles Gomes 1944) Ewing 1962 - Serovar 019:H2 | ATCC 9886 | DSM 30120

†*Providencia friedericiana* [VP] Müller et al. 1986 = *Providencia rustigianii* (senior heterotypic synonym) - 1 33 | DSM 2620

*Providencia heimbachae* [VP] Müller et al. 1986 - MUA 2-110 | ATCC 35613 | CDC 8025-83 | DSM 3591

*Providencia rettgeri* [AL] (Hadley et al. 1918) Brenner et al. 1978 = *Proteus rettgeri* (homotypic synonym) - Biovar 2a | ATCC 29944 | DSM 4542

*Providencia rustigianii* [VP] Hickman-Brenner et al. 1983 = *Providencia friedericiana* (junior heterotypic synonym) - ATCC 33673 | CDC 0132-68 | DSM 4541

*Providencia stuartii* [AL] (Buttiaux et al. 1954) Ewing 1962 - ATCC 29914, AF008581 | CDC 2896-68 | DSM 4539

*Genus XXXI. Rahnella* [VP]

*Rahnella aquatilis* [VP (T)] Izard et al. 1981 - 133 | ATCC 33071 | CIP 78-65 | CUETM 75.115 | DSM 4594, AJ233426

*Genus XXXII. Raoultella* [VP]

*Raoultella planticola* [VP (T)] (Bagley et al. 1982) Drancourt et al. 2001 <- *Klebsiella planticola* (basonym) - V-236 | ATCC 33531, Y17659, K.plantic4 | ATCC 33531, AF129443 | CDC 4245-72 | CIP 100751 | DSM 3069, X93215, K.plantico | IAM 14202 | NBRC 14939 | JCM 7251, AB004755, K.plantic3

*Raoultella ornithinolytica* [VP] (Sakazaki et al. 1989) Drancourt et al. 2001 <- *Klebsiella ornithinolytica* (basonym) - ATCC 31898, AF129441 | CIP 103576 | DSM 7464 | JCM 6096, AJ251467 | NIH 90–72

*Raoultella terrigena* [VP] (Izard et al. 1981) Drancourt et al. 2001 <- *Klebsiella terrigena* (basonym) - Gavini L 84 | ATCC 33257, AF129442, Y17658, K.terrigen | CIP 80-07 | CIP 103576 | CUETM 77-176 | DSM 2687

*Genus XXXIII. Saccharobacter* [VP]

*Saccharobacter fermentatus* [VP (T)] Yaping et al. 1990 - WVB 8512

*Genus XXXIV. Salmonella* [AL 277]

*Salmonella enterica subsp. enterica* [(T)] (ex Kauffmann and Edwards 1952) Le Minor and Popoff 1987 = *Salmonella choleraesuis subsp. choleraesuis* (heterotypic synonym) = *Salmonella enteritidis* (heterotypic synonym) = *Salmonella paratyphi* (heterotypic synonym) = *Salmonella typhi* (heterotypic synonym) = *Salmonella typhimurium* (heterotypic synonym) - LT2 | ATCC 43971 | CIP 60.62 | NCIMB 11450 | NCTC 8385

[277] In a Request for an Opinion published in 1987, Le Minor and Popoff proposed replacement of the type species of *Salmonella* (*Salmonella choleraesuis* subsp. *choleraesuis*) with *Salmonella enterica* as the former was considered to be a source of confusion. Although the Request was denied by the Judicial Commission, their proposal resulted in an alternative naming convention which has found widespread endorsement in the public health community. This matter was revisited in July 2002 by the Judicial Commission during the IUMS Congress in response to several new Requests for an Opinion, and will likely result in a decision to replace the type strain *Salmonella choleraesuis* subsp. *choleraesuis* with *Salmonella enterica* subsp *enterica* stain LT2, while preserving the former rather than placing it on the list of rejected names. We view the six subspecies of *Salmonella choleraesuis* as deprecated, as indicated by the dagger symbol (†) preceding these names. Readers are also advised that names *Salmonella enteritidis*, *Salmonella paratyphi*, *Salmonella typhi* and *Salmonella paratyphi* are synonyms of *Salmonella enterica* subsp. *enterica* and refer to specific serovars. These names have not been deprecated at this time as they remain in use by some public health reporting agencies.

*Salmonella enterica subsp. arizonae* (Borman 1957) Le Minor and Popoff 1987 <- *Salmonella choleraesuis subsp. arizonae* (basonym) - ATCC 13314|CCUG 6322|CIP 82.30|DSM 9386|NCTC 8297

†*Salmonella enterica subsp. bongori* Le Minor et al. 1985) Le Minor and Popoff 1987 <- *Salmonella choleraesuis subsp. bongori* (basonym) -> *Salmonella bongori*, AF029227, S.bongori1 - ATCC 43975|CIP 82.33

*Salmonella enterica subsp. diarizonae* (Le Minor et al. 1985) Le Minor and Popoff 1987 <- *Salmonella choleraesuis subsp. diarizonae* (basonym) - ATCC 43973|CCUG 30040|CIP 82.31|NCTC 10060

*Salmonella enterica subsp. houtenae* (Le Minor et al. 1985) Le Minor and Popoff 1987 <- *Salmonella choleraesuis subsp. houtenae* (basonym) - ATCC 43974|CCUG 30041|CIP 82.32|DSM 9221|NCTC 12418

*Salmonella enterica subsp. indica* (Le Minor et al. 1985) Le Minor and Popoff 1987 <- *Salmonella choleraesuis subsp. indica* (basonym) - K1240|ATCC 43976|CCUG 30038|CIP 102501|NCTC 12420

*Salmonella enterica subsp. salamae* (Le Minor et al. 1985) Le Minor and Popoff 1987 <- *Salmonella choleraesuis subsp. salamae* (basonym) - ATCC 43972|CCUG 30039|CIP 8229|DSM 9220|NCTC 5773

*Salmonella bongori* [VP] (Le Minor et al. 1985) Reeves et al. 1989 <- *Salmonella choleraesuis subsp. bongori* (basonym) - 66:z41:-, AF029227, S.bongori1|ATCC 43975|CIP 82.33

†*Salmonella choleraesuis subsp. choleraesuis* [AL] (Smith 1894) Weldin 1927 <- (basonym) = *Salmonella enterica subsp. enterica* (heterotypic synonym) - ATCC 13312|ATCC 13314|CIP 55-133|NCTC 5735

†*Salmonella choleraesuis subsp. arizonae* [VP] (Borman 1957) Le Minor et al. 1985 <- *Salmonella arizonae* (basonym) -> *Salmonella enterica subsp. arizonae* - Serovar 51:z4,z23|ATCC 13314|CIP 82.30|DSM 9386|NCTC 8297

†*Salmonella choleraesuis subsp. bongori* [VP] Le Minor et al. 1985 -> *Salmonella bongori* - CIP 82.33

†*Salmonella choleraesuis subsp. diarizonae* [VP] Le Minor et al. 1985 -> *Salmonella enterica subsp. diarizonae* - CIP 82.31|NCTC 10060

†*Salmonella choleraesuis subsp. houtenae* [VP] Le Minor et al. 1985 -> *Salmonella enterica subsp. houtenae* - Serovar 45:g,z51|ATCC 43974|CIP 82.32|DSM 9221

†*Salmonella choleraesuis subsp. indica* [VP] Le Minor et al. 1987 -> *Salmonella enterica subsp. indica* - K1240|CIP 102501

†*Salmonella choleraesuis subsp. salamae* [VP] Le Minor et al. 1985 -> *Salmonella enterica subsp. salamae* - CIP 82.29|DSM 9220|NCTC 5773

†*Salmonella arizonae* [AL] (Bowman 1957) Kauffman 1964 -> *Salmonella choleraesuis subsp. arizonae* - ATCC 13314|NCTC 8297

*Salmonella enteritidis* [AL] (Gaertner 1888) Castellani and Chalmers 1919 = *Salmonella enterica subsp. enterica* (heterotypic synonym) - ATCC 13076

*Salmonella paratyphi* [VP] Ezaki et al. 2000 = *Salmonella enterica subsp. enterica* (heterotypic synonym) - KI 1015|NCTC 5702

*Salmonella typhi* [AL] (Schroeter 1886) Warren and Scott 1930 = *Salmonella enterica subsp. enterica* (heterotypic synonym) - ATCC 19430, Z47544, S.typhi2

*Salmonella typhimurium* [AL] (Loeffler 1892) Castellani and Chalmers 1919 = *Salmonella enterica subsp. enterica* (heterotypic synonym) - ATCC 13311, X80681, S.typmurium|NCTC 74

*Genus XXXV. Samsonia* [VP]

*Samsonia erythrinae* [VP (T)] Sutra et al. 2001 - CFBP 5236, AF273037|ICMP 13937

*Genus XXXVI. Serratia* [AL]

*Serratia marcescens subsp. marcescens* [AL (T)] Bizio 1823 - ATCC 13880, M59160, Ser.marces|CCM 303|DSM 30121|DSM 47|NCDC 813-60|NCIB 9155|NCTC 10211

*Alicyclobacillus cycloheptanicus* [VP] (Deinhard et al. 1988) Wisotzkey et al. 1992 <- *Bacillus cycloheptanicus* (basonym) - SCH | ATCC 49028 | DSM 4006, X51928, AB042059 | NBRC 15310

*Alicyclobacillus herbarius* [VP] Goto et al. 2002 - CP-1, AB042055 | DSM 13609 | IAM 14883 | NRIC 0477

*Alicyclobacillus hesperidum* [VP] Albuquerque et al. 2000 - FR-11, AJ133633 | DSM 12489

*Alicyclobacillus sendaiensis* [VP] Tsuruoka et al. 2003 - NTAP-1, AB084128 | ATCC BAA-609 | JCM 11817

*Genus II. Pasteuria* [AL]

*Pasteuria ramosa* [AL (T)] Metchnikoff 1888 [397]

*Pasteuria nishizawae* [VP] Sayre et al. 1992

*Pasteuria penetrans* [VP] (ex Thorne 1940) Sayre and Starr 1986

*Pasteuria thornei* [VP] Starr and Sayre 1988 - ATCC 15713

*Genus III. Sulfobacillus* [VP] [398]

*Sulfobacillus thermosulfidooxidans* [VP (T)] Golovacheva and Karavaiko 1991 - AT-1, X91080, Sfb.tsoxi2 | DSM 9293 | VKM B-1269, Z21979, Sfb.tsoxid

*Sulfobacillus acidophilus* [VP] Norris et al. 1996 - NAL, AF050169 | DSM 10332, Sfb.acidop

*Sulfobacillus disulfidooxidans* [VP] Dufresne et al. 1996 - SD-11, U34974, Sfb.dislfx | SD-6 | ATCC 51911 | DSM 12064

*Family III. Caryophanaceae* [AL]

*Genus I. Caryophanon* [AL (T)]

*Caryophanon latum* [AL (T)] Peshkoff 1939 - NCIB 9533, X70314, Crp.latum2

*Caryophanon tenue* [VP] (Peshkoff 1939) Trentini 1988 - NCIB 9535

*Family IV. "Listeriaceae"*

*Genus I. Listeria* [AL]

*Listeria monocytogenes* [AL (T)] (Murray et al. 1926) Pirie 1940 - 53 XXIII | ATCC 15313 | DSM 20600 | NCTC 10357, X56153, Lis.monoc2 | SLCC 53

†*Listeria denitrificans* [AL] Prevot 1961 -> *Jonesia denitrificans* - 55134 | ATCC 14870 | CIP 55134 | DSM 20603 | IMET 7763 | NCTC 10816

*Listeria grayi* [AL] Errebo Larsen and Seeliger 1966 = *Listeria murrayi* (junior heterotypic synonym) - Li 2080 | ATCC 19120, X98526, Lis.grayi2 | DSM 20601

*Listeria innocua* [VP] Seeliger 1983 - 58 | ATCC 33090, X98527, Lis.innoc3 | DSM 20649 | NCTC 11288, X56152, Lis.innocu | SLCC 3379

*Listeria ivanovii subsp. ivanovii* [VP] Seeliger et al. 1984 - Li 1979 | ATCC 19119 | CLIP 12510, X98528, Lis.ivano2 | DSM 20750 | SLCC 2739

*Listeria ivanovii subsp. londoniensis* [VP] Boerlin et al. 1992 - CNL 89/5081 | CIP 103466 | CLIP 12229, X98529, Lis.ivano3 | DSM 12491

†*Listeria murrayi* [AL] Welshimer and Meredith 1971 = *Listeria grayi* (senior heterotypic synonym) - ATCC 25401 | CIP 76124 | DSM 20596 | NCTC 10812, X56154, Lis.grayi3

*Listeria seeligeri* [VP] Rocourt and Grimont 1983 - 1120 | ATCC 35967 | CIP 100100 | DSM 20751 | NCTC 11856, X56148, Lis.seelig | SLCC 3954

*Listeria welshimeri* [VP] Rocourt and Grimont 1983 - V8 | ATCC 35897, X98532, Lis.welsh2 | CIP 8149 | DSM 20650 | SLCC 5334

*Genus II. Brochothrix* [AL]

*Brochothrix thermosphacta* [AL (T)] (McLean and Sulzbacher 1953) Sneath and Jones 1976 - SW 26 | ATCC 11509, M58798, Bro.thermo | DSM 20171 | IMET 11238 | NCDO 1676, X56155, Bro.therm2 | NCIB 10018

*Brochothrix campestris* [VP] Talon et al. 1988 - S3 | ATCC 43754, X56156, Bro.campes | CIP 102920 | DSM 4712

[397] Strain ATCC 27377 was proposed as a neotype strain for *Pasteuria ramosa* but was rejected. It is now the type strain of *Pirellula staleyi*.
[398] Ludwig states that *Sulfobacillus* might be a member of a separate phylum. Hugenholtz supports this view.

*Planomicrobium koreense* VP (T) Yoon et al. 2001 - JG07, AF144750 | JCM 10704 | KCTC 3684

*Planomicrobium mcmeekinii* VP (Junge et al. 1998) Yoon et al. 2001 [404] <- *Planococcus mcmeekinii* (basonym) - S23F2, AF041791, Plc.mcmeek | ATCC 700539

*Planomicrobium okeanokoites* VP (ZoBell and Upham 1944) Yoon et al. 2001 [405] <- *Planococcus okeanokoites* (basonym) - CCM 320 | NBRC 12536, D55729, Plc.okeano | NCIMB 561

*Genus V. Sporosarcina* AL

*Sporosarcina ureae* AL (T) (Beijerinck 1901) Kluyver and van Niel 1936 - ATCC 6473 | CCM 684 | DSM 2281 | NCIB 9251, X62175, Spo.ureae

*Sporosarcina aquimarina* VP Yoon et al. 2001 - SW28, AF202056 | JCM 10887 | KCCM 41039

*Sporosarcina globispora* VP (Larkin and Stokes 1967) Yoon et al. 2001 [406] <- *Bacillus globisporus subsp. globisporus* (basonym) - W 25, X54967, B.globisp2 | ATCC 23301 | CCM 2119 | DSM 4, X68415, B.globisp3 | NCIB 11434, X60644, B.globispr

†*Sporosarcina halophila* VP Claus et al. 1984 -> *Halobacillus halophilus* - 3 | ATCC 35676 | DSM 2266

*Sporosarcina pasteurii* VP (Miquel 1889) Yoon et al. 2001 [407] <- *Bacillus pasteurii* (basonym) - 22 | ATCC 11859 | CCM 2056 | DSM 33 | NCIMB 8841, X60631, B.pasteuri | NCTC 4822

*Sporosarcina psychrophila* VP (Nakamura 1984) Yoon et al. 2001 [408] <- *Bacillus psychrophilus* (basonym) - W16A, X54968, B.psycphi2 | ATCC 23304, X60634, B.psycphil | CCM 2117 | DSM 3 | IAM 12468, D16277 | NRRL NRS 1530

*Family VII. "Sporolactobacillaceae"*

*Genus I. Sporolactobacillus* AL

*Sporolactobacillus inulinus* AL (T) (Kitahara and Suzuki 1963) Kitahara and Lai 1967 - EU | ATCC 15538, M58838, Spl.inulin | CIP 103279 | DSM 20348 | IAM 12543 | NBRC 13595 | JCM 6014, D16283, Spl.inuli2 | NCIMB 9743

*Sporolactobacillus kofuensis* VP Yanagida et al. 1997 - M-19 | JCM 3419 | LMG 18786

*Sporolactobacillus lactosus* VP Yanagida et al. 1997 - X1-1 | JCM 9690

*Sporolactobacillus nakayamae subsp. nakayamae* VP Yanagida et al. 1997 - M-114 | DSM 11696 | JCM 3514

*Sporolactobacillus nakayamae subsp. racemicus* VP Yanagida et al. 1997 - M-17 | JCM 3417 | LMG 18785

*Sporolactobacillus terrae* VP Yanagida et al. 1997 - M-116, D16289, Spl.racmi3 | DSM 11697 | JCM 3516

*Genus II. Marinococcus* VP

*Marinococcus halophilus* VP (T) (Novitsky and Kushner 1976) Hao et al. 1985 <- *Planococcus halophilus* (basonym) - HK 718 | ATCC 27964 | CCM 2706 | DSM 20408, X90835, Mrc.halop2 | IAM 12844 | JCM 2479 | NRCC 14033

*Marinococcus albus* VP Hao et al. 1985 - HK 733 | CCM 3517 | DSM 20748, X90834, Mrc.albus1 | IAM 12845 | JCM 2574

†*Marinococcus hispanicus* VP Marquez et al. 1990 -> *Salinicoccus hispanicus* - J-82 | ATCC 49259 | CCM 4148 | DSM 5352, AY028927

*Family VIII. "Staphylococcaceae"*

*Genus I. Staphylococcus* AL

[404] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

[405] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

[406] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

[407] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

[408] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

*Staphylococcus aureus subsp. aureus* [AL (T)] Rosenbach 1884 - 533 R4 | ATCC 12600, D83357, Stp.aure10 | ATCC 12600, L36472, Stp.aureu4 | ATCC 12600, L37597, Stp.aureu5 | ATCC 12600, X68417, Stp.aureus | CCM 885 | DSM 20231 | NCDO 949, X70648, Stp.aureu2 | NCTC 8532

*Staphylococcus aureus subsp. anaerobius* [VP] De La Fuente et al. 1985 - MVF-7 | ATCC 35844, D83355, Stp.aureu8 | DSM 20714

*Staphylococcus arlettae* [VP] Schleifer et al. 1985 - BP47 | ATCC 43957, AB009933, Stp.arlet2 | DSM 20672

*Staphylococcus auricularis* [VP] Kloos and Schleifer 1983 - WK 811M | ATCC 33753, D83358, Stp.auric4 | ATCC 33753, L37598, Stp.auric3 | DSM 20609

*Staphylococcus capitis subsp. capitis* [AL] Kloos and Schleifer 1975 - LK 499 | ATCC 27840, L37599, Stp.capit2 | CCM 2734 | DSM 20326

*Staphylococcus capitis subsp. urealyticus* [VP] Bannerman and Kloos 1991 - MAW 8436 | ATCC 49326, AB009937, Stp.capit3 | DSM 6717

*Staphylococcus caprae* [VP] Devriese et al. 1983 - 143.22 | ATCC 35538, AB009935, Stp.capra2 | CCM 3573 | DSM 20608, Y12593, Stp.capra3

*Staphylococcus carnosus subsp. carnosus* [VP] Schleifer and Fischer 1982 - 361 | ATCC 51365, AB009934, Stp.carno2 | DSM 20501

*Staphylococcus carnosus subsp. utilis* [VP] Probst et al. 1998 - LTH 3728 | SK 11 | DSM 11676 | JCM 6067

†*Staphylococcus caseolyticus* [VP] Schleifer et al. 1982 -> *Macrococcus caseolyticus* - ATCC 13548, D83359, Mac.caseo2 | ATCC 13548, Y15711, Mac.caseol | DSM 20597

*Staphylococcus chromogenes* [VP] (Devriese et al. 1978) Hajek et al. 1987 <- *Staphylococcus hyicus subsp. chromogenes* (basonym) - 1462 | ATCC 43764, D83360, Stp.chromo | CCM 3387 | DSM 20454 | NCTC 10530

*Staphylococcus cohnii subsp. cohnii* [AL] Schleifer and Kloos 1975 - GH 137 | ATCC 29974, D83361, Stp.cohni2 | CCM 2736 | DSM 20260

*Staphylococcus cohnii subsp. urealyticus* [VP] Kloos and Wolfshohl 1991 - CK27 | ATCC 49330, AB009936, Stp.cohni3 | DSM 6718

*Staphylococcus condimenti* [VP] Probst et al. 1998 - F-2 | LTH 3734 | DSM 11674, Y15750, Stp.cndmnt, Y15750, Stp.cndmnt | JCM 6074

*Staphylococcus delphini* [VP] Varaldo et al. 1988 - Heidy | ATCC 49171, AB009938, Stp.delphn | DSM 20771

*Staphylococcus epidermidis* [AL] (Winslow and Winslow 1908) Evans 1916 - Fussel | ATCC 14990, D83363, Stp.epide9 | ATCC 14990, L37605, Stp.epide5 | CCM 2124 | DSM 20044

*Staphylococcus equorum* [VP] Schleifer et al. 1985 - PA23 | ATCC 43958, AB009939, Stp.equor2 | ATCC 43958, AF041363, Stp.equor3 | DSM 20674, AF041363, Stp.equor3

*Staphylococcus felis* [VP] Igimi et al. 1989 - GD521 | SG521 | ATCC 49168, D83364, Stp.felis1 | DSM 7377 | JCM 7469

*Staphylococcus fleurettii* [VP] Vernozy-Rozand et al. 2000 - 241 | CIP 106114 | DSM 13212

*Staphylococcus gallinarum* [VP] Devriese et al. 1983 - VIII1 | ATCC 35539, D83366, Stp.gallin | CCM 3572 | DSM 20610

*Staphylococcus haemolyticus* [AL] Schleifer and Kloos 1975 - SM 131 | ATCC 29970, L37600, Stp.haemo3 | ATCC 29970, D83367, Stp.haemo4 | CCM 2737, X66100, Stp.haemo2 | DSM 20263

*Staphylococcus hominis subsp. hominis* [AL] Kloos and Schleifer 1975 emend. Kloos et al. 1998 - DM 122 | ATCC 27844, L37601, Stp.homin3 | DSM 20328, X66101, Stp.homin2

*Staphylococcus hominis subsp. novobiosepticus* [VP] Kloos et al. 1998 - R22 | ATCC 700236

*Staphylococcus hyicus subsp. hyicus* [AL] (Sompolinsky 1953) Devriese et al. 1978 - 1 | ATCC 11249, D83368, Stp.hyicus | CCM 2368 | DSM 20459 | NCTC 10350

†*Staphylococcus hyicus subsp. chromogenes* [AL] Devriese et al. 1978 -> *Staphylococcus chromogenes* - MAFF911474, D83360 | ATCC 43764 | CCM 3387 | DSM 20454 | NCTC 10530

*Staphylococcus intermedius* [AL] Hajek 1976 - ATCC 29663, D83369, Stp.intme2 | CCM 5739 | DSM 20373 | H11 | NCTC 11048

*Staphylococcus kloosii* [VP] Schleifer et al. 1985 - SC210 | ATCC 43959, AB009940, Stp.kloos2 | DSM 20676

*Staphylococcus lentus* [VP] (Kloos et al. 1967) Schleifer et al. 1983 <- *Staphylococcus sciuri subsp. lentus* (basonym) - K21 | ATCC 29070, D83370, Stp.lentus | DSM 20352

*Staphylococcus lugdunensis* [VP] Freney et al. 1988 - N860297 | ATCC 43809, AB009941, Stp.lugdu2 | DSM 4804

*Staphylococcus lutrae* [VP] Foster et al. 1997 - M340/94/1 | DSM 10244 | DSM 10244, X84731, Stp.lutrae

*Staphylococcus muscae* [VP] Hájek et al. 1992 - MB4, S83566, Stp.muscae | ATCC 49910 | CCM 4175, S83566, Stp.muscae | DSM 7068

*Staphylococcus nepalensis NP* Spergser et al. 2003 - CCM 7045 | CW1, AJ517414 | DSM 15150

*Staphylococcus pasteuri* [VP] Chesneau et al. 1993 - BM9357 | ATCC 51129, AB009944, Stp.pasteu | ATCC 51129, AF041361, Stp.paste2 | CCM 4389 | DSM 10656

*Staphylococcus piscifermentans* [VP] Tanasupawat et al. 1992 - SK03, Y15754, Stp.pisci2 | ATCC 51136, AB009943, Stp.pisci | DSM 7373 | JCM 6057 | NCIMB 13277 | NRIC 1817 | TISTR 824

*Staphylococcus pulvereri* [VP] Zakrzewska-Czerwinska et al. 1995 = *Staphylococcus vitulinus* (senior heterotypic synonym) - NT215, U12764, Stp.pulver | ATCC 51698, AB009942, Stp.pulve2 | DSM 9930 | PCM 2443

*Staphylococcus saccharolyticus* [VP] (Foubert and Douglas 1948) Kilpper-Bälz and Schleifer 1984 <- *Peptococcus saccharolyticus* (basonym) - S1 | ATCC 14953, L37602, Stp.sacly2 | DSM 20359

*Staphylococcus saprophyticus subsp. saprophyticus* [AL] (Fairbrother 1940) Shaw et al. 1951 - S-41 | ATCC 15305, D83371, Stp.sapro4 | ATCC 15305, L37596, Stp.sapro3 | CCM 883 | DSM 20229 | NCIB 8711 | NCTC 7292

*Staphylococcus saprophyticus subsp. bovis* [VP] Hájek et al. 1996 - KV 12 | CCM 4410

*Staphylococcus schleiferi subsp. schleiferi* [VP] Freney et al. 1988 - N850274 | ATCC 43808 | DSM 4807 | DSM 4807, S83568, Stp.schlei

*Staphylococcus schleiferi subsp. coagulans* [VP] Igimi et al. 1990 - GA211 | ATCC 49545, AB009945, Stp.schle5 | CIP 104370 | DSM 6628 | JCM 7470

*Staphylococcus sciuri subsp. sciuri* [AL] Kloos et al. 1976 emend. Kloos et al. 1997 - SC 116 | ATCC 29062 | DSM 20345, AJ421446

*Staphylococcus sciuri subsp. carnaticus* [VP] Kloos et al. 1997 - DD 791 | ATCC 700058

†*Staphylococcus sciuri subsp. lentus* [AL] Kloos et al. 1976 -> *Staphylococcus lentus* - K21 | ATCC 29070, D83370, Stp.lentus | DSM 20352

*Staphylococcus sciuri subsp. rodentium* [VP] Kloos et al. 1997 - DD 4761 | R1-33 | ATCC 700061

*Staphylococcus simulans* [AL] Kloos and Schleifer 1975 - MK 148 | ATCC 27848, D83373, Stp.simuln | CCM 2705 | DSM 20322

*Staphylococcus succinus* [VP] Lambert et al. 1998 - AMG-D1, AF004220, Stp.succin | ATCC 700337

*Staphylococcus succinus subsp. succinus* [VP] Lambert et al. 2003 - AMG-D1, AF004220 | ATCC 700337

*Staphylococcus succinus subsp. casei* [VP] Place et al. 2003 - SB72, AJ320272 | CIP 107658 | DSM 15096

*Staphylococcus vitulinus* [VP] Webster et al. 1994 = *Staphylococcus pulvereri* (junior heterotypic synonym) - DD 756 | ATCC 51145, AB009946, Stp.vitulu

*Staphylococcus warneri* [AL] Kloos and Schleifer 1975 - AW 25|ATCC 27836, L37603, Stp.warne2|CCM 2730|DSM 20316

*Staphylococcus xylosus* [AL] Schleifer and Kloos 1975 - KL 162|ATCC 29971, D83374, Stp.xylos2|CCM 2738|DSM 20266

*Genus II. Gemella* [AL]

*Gemella bergeri* [VP] Collins et al. 1998 - 617-93, Y13365|CCUG 37817

*Gemella cuniculi* [VP] Hoyles et al. 2000 - M60449/99/1, AJ251987|CCUG 42726|CIP 106481

*Gemella haemolysans* [AL] (Thjotta and Boe 1938) Berger 1960 - ATCC 10379, L14326, Gem.haemo2|ATCC 10379, M58799, Gem.haemol|NCTC 5414

*Gemella morbillorum* [VP] (Prevot 1933) Kilpper-Bälz and Schleifer 1988 <- *Streptococcus morbillorum* (basonym) - 2917B|ATCC 27824, L14327, Gem.morbil|DSM 20572|VPI 5424

*Gemella palaticanis* [VP] Collins et al. 1999 - M663-98-1|CCUG 39489, Y17280

*Gemella sanguinis* [VP] Collins et al. 1999 - 2045-94, Y13364, Gem.sangui|CCUG 37820

*Genus III. Jeotgalicoccus* [VP]

*Jeotgalicoccus halotolerans* [VP (T)] Yoon et al. 2003 - YKJ-101, AY028925|JCM 11198|KCCM 41448

*Jeotgalicoccus psychrophilus* [VP] Yoon et al. 2003 - YKJ-115, AY028926|JCM 11199|KCCM 41449

*Genus IV. Macrococcus* [VP]

*Macrococcus equipercicus* [VP (T)] Kloos et al. 1998 - DD 9350|ATCC 51831

*Macrococcus bovicus* [VP] Kloos et al. 1998 - DD 4516|ATCC 51825

*Macrococcus carouselicus* [VP] Kloos et al. 1998 - DD 9348|ATCC 51828

*Macrococcus caseolyticus* [VP] (Schleifer et al. 1982) Kloos et al. 1998 <- *Staphylococcus caseolyticus* (basonym) - DD 4508|ATCC 13548, D83359, Mac.caseo2|ATCC 13548, Y15711, Mac.caseol|DSM 20597

*Genus V. Salinicoccus* [VP]

*Salinicoccus roseus* [VP (T)] Ventosa et al. 1990 - 9|ATCC 49258|CCM 3516|DSM 5351, X94559, Sc.roseus2

*Salinicoccus alkaliphilus* [VP] Zhang et al. 2002 - T8, AF275710|AS 1.2691|JCM 11311

*Salinicoccus hispanicus* [VP] (Marquez et al. 1990) Ventosa et al. 1993 <- *Marinococcus hispanicus* (basonym) - J-82|ATCC 49259|CCM 4148|DSM 5352, AY028927

*Family IX. "Thermoactinomycetaceae"* [409]

*Genus I. Thermoactinomyces* [AL]

*Thermoactinomyces vulgaris* [AL (T)] Tsilinsky 1899 - ATCC 43649|CBS 505.77|CUB 250|DSM 43016|NBRC 13606|IMET 9711|JCM 3162|KCC A-0162|NCIB 11364, M77491, Ta.vulgari

*Thermoactinomyces candidus* [AL] Kurup et al. 1975 - T-106|ATCC 27868|DSM 43352|KCTC 9557, AF138732

*Thermoactinomyces dichotomicus* [AL] (Krassilnikov and Agre 1964) Cross and Goodfellow 1973 - N1595|ATCC 49854|CUB 581|INMI 114|NCIMB 10211, L16902, Ta.dichoto

*Thermoactinomyces intermedius* [VP] Kurup et al. 1981 - T-323|ATCC 33205, AJ251775|DSM 43846

*Thermoactinomyces peptonophilus* [AL] Nonomura and Ohara 1971 - ATCC 27302|KCTC 9740, AF138735

*Thermoactinomyces putidus* [VP] Lacey and Cross 1989 - KCTC 3666, AF138736|NCIB 12324

*Thermoactinomyces sacchari* [AL] Lacey 1971 - A 978|ATCC 27375|CBS 701.70|CUB 618|DSM 43356, AJ251779|NBRC 13920|IMET 9713, KCTC 9790, AF138737|NCIB 10486|NCTC 10721

*Thermoactinomyces thalpophilus* [VP] Lacey and Cross 1989 - ATCC 49855|CBS 319.66|CUB 808|DSM 43354|KCTC 9789, AF138738|NBRC 15852|JCM 3217

[409] Ludwig indicates that within the ARB tree, the *Thermoactinomycetaceae* represents deep lineage within the *Bacillales*.

*Family X. "Turicibacteraceae"*[410]
*Genus I. Turicibacter* [VP (T)]
*Turicibacter sanguinis* [VP] Bosshard et al. 2002 - MOL361, AF349724 | DSM 14220 | NCCB 100008
*Order II. "Lactobacillales"*
*Family I. Lactobacillaceae* [AL]
*Genus I. Lactobacillus* [AL (T)]
*Lactobacillus delbrueckii subsp. delbrueckii* [AL (T)] (Leichmann 1896) Beijerinck 1901 - 730 | ATCC 9649 | DSM 20074, M58814, L.delbruck | NCDO 213, X52654, L.delbruc2 | NCIB 8130
*Lactobacillus delbrueckii subsp. bulgaricus* [VP] (Orla-Jensen 1919) Weiss et al. 1984 <- *Lactobacillus bulgaricus* (basonym) - Lb.14 | ATCC 11842, AY050171 | DSM 20081 | IMET 10708 | JCM 1002, AB007908, L.delbruc3 | LMG 6901 | NCDO 1489
*Lactobacillus delbrueckii subsp. lactis* [VP] (Orla-Jensen 1919) Weiss et al. 1984 <- *Lactobacillus lactis* (basonym) - L 110 | ATCC 12315 | DSM 20072, M58823, L.delbruc4 | NCDO 1438
*Lactobacillus acetotolerans* [VP] Entani et al. 1986 - NBI 3014 | ATCC 43578 | DSM 20749, M58801, L.acetoler | JCM 3825
*Lactobacillus acidipiscis* [VP] Tanasupawat et al. 2000 - FS60-1, AB023836 | PCU 207 | NRIC 0300 | HSCC 1411 | JCM 10692 | TISTR 1386
*Lactobacillus acidophilus* [AL] (Moro 1900) Hansen and Mocquot 1970 - Scav | ATCC 4356, M58802, L.acidophi | DSM 20079, M58802, L.acidophi | IMET 10710 | NCDO 1748 | NCIB 8690, X61138, L.acidoph1
*Lactobacillus agilis* [VP] Weiss et al. 1982 - 262 | DSM 20509, M58803, L.agilis | NCIB 11716
*Lactobacillus algidus* [VP] Kato et al. 2000 - M6A9 | JCM 10491, AB033209
*Lactobacillus alimentarius* [VP] Reuter 1983 - R 13 | ATCC 29643 | DSM 20249, M58804, L.alimenta
*Lactobacillus amylolyticus* [VP] Bohak et al. 1999 - LA 5, Y17361, L.amylytic | DSM 11664
*Lactobacillus amylophilus* [VP] Nakamura and Crowell 1981 - ATCC 49845 | DSM 20533, M58806 | NRRL B-4437
*Lactobacillus amylovorus* [VP] Nakamura 1981 - ATCC 33620 | DSM 20531, M58805, L.amyvorus | NRRL B-4540
*Lactobacillus animalis* [VP] Dent and Williams 1983 - 1535 | PPI/1535 | ATCC 35046 | DSM 20602, M58807, L.animalis | NCDO 2425, X61133, L.animal1
*Lactobacillus arizonensis* [VP] Swezey et al. 2000 - DSM 13273 | NRRL B-14768, AF093757
*Lactobacillus aviarius subsp. aviarius* [VP] Fujisawa et al. 1986 - 75 | ATCC 43234 | DSM 20655, M58808, L.aviarius
*Lactobacillus aviarius subsp. araffinosus* [VP] Fujisawa et al. 1986 - ML2 | ATCC 43235 | DSM 20653
†*Lactobacillus bavaricus* [VP] Stetter and Stetter 1980 = *Lactobacillus sakei* (senior heterotypic synonym) - ATCC 31063 | DSM 20269
*Lactobacillus bifermentans* [VP] Kandler et al. 1983 - N2 | ATCC 35409 | DSM 20003, M58809, L.bifermen | JCM 1094, D31680, L.biferme2 | LMG 9845
*Lactobacillus brevis* [AL] (Orla-Jensen 1919) Bergey et al. 1934 - Bb14 | ATCC 14869, M58810, L.brevis | DSM 20054 | IMET 10711 | NCDO 1749, X61134, L.brevis1
*Lactobacillus buchneri* [AL] (Henneberg 1903) Bergey et al. 1923 - ATCC 4005 | CCM 1819 | DSM 20057, M58811, L.buchneri | IMET 10692 | NCDO 110, X61139, L.buchner1 | NCIB 8007

[410] This family was created to accommodate *Turicibacter sanguinis* which was reported by Bosshard et al. as being equidistant from *Paenibacillus* and *Gemella*.

†*Lactobacillus bulgaricus* [AL] (Orla-Jensen 1919) Rogosa and Hansen 1971 -> *Lactobacillus delbrueckii bulgaricus* - ATCC 11842, AY050171 | DSM 20081 | IMET 10708

†*Lactobacillus carnis* [VP] Shaw and Harding 1986 = *Lactobacillus piscicola* (senior heterotypic synonym) - LV61 | ATCC 43225 | NCDO 2764 | DSM 20722, M58812

*Lactobacillus casei subsp. casei* [AL] (Orla-Jensen 1916) Hansen and Lessel 1971 - ATCC 393, D16551, L.casei_ca | ATCC 393, M23928, L.casei | DSM 20011 | NCDO 161, D16551, L.casei_ca | NCDO 161, X61135, L.casei |

†*Lactobacillus casei subsp. alactosus* [AL] Mills and Lessel 1973 = *Lactobacillus paracasei subsp. paracasei* (senior heterotypic synonym) - ATCC 27216, D16548, L.prcasei2 | DSM 20020

†*Lactobacillus casei subsp. pseudoplantarum* [AL] Abo-Elnaga and Kandler 1965 = *Lactobacillus paracasei subsp. paracasei* (senior heterotypic synonym) - ATCC 25598, D16549, L.prcasei3 | DSM 20008 | NCIB 9713

†*Lactobacillus casei subsp. rhamnosus* [AL] Hansen 1968 -> *Lactobacillus rhamnosus* - ATCC 7469, D16552, L.rhamnos2 | CCM 1825 | DSM 20021, M58815, L.rhamnosu | IMET 10691 | NCDO 243, D16552, L.rhamnos2 | NCIB 6375

†*Lactobacillus casei subsp. tolerans* [AL] Abo-Elnaga and Kandler 1965 -> *Lactobacillus paracasei subsp. tolerans* - 27211 | ATCC 25599, D16550, L.prcas_to | DSM 20258 | NCIB 9709

*Lactobacillus catenaformis* [AL] (Eggerth 1935) Moore and Holdeman 1970 - 1871 | ATCC 25536, M23729, L.catenafo | DSM 20559 | VPI 2933

*Lactobacillus cellobiosus* [AL] Rogosa et al. 1953 - 19 LC 3 | ATCC 11739 | CECT 562, AJ575812 | DSM 20055 | NCDO 928

*Lactobacillus coleohominis* [VP] Nikolaitchouk et al. 2001 - CIP 106820 | CCUG 44007 | DSM 14060

*Lactobacillus collinoides* [AL] Carr and Davies 1972 - Cl3a | ATCC 27612 | DSM 20515 | JCM 1123, AB005893, L.collinoi | JCM 1123, D31683, L.collino2 | LMG 9149 | NCIB 10925

†*Lactobacillus confusus* [AL] (Holzapfel and Kandler 1969) Sharpe et al. 1972 -> *Weissella confusa* - 548-D | ATCC 10881 | DSM 20196, M23036, Wei.confus | NCDO 1586, X52567, Wei.confu2 | NCIB 9311

*Lactobacillus coryniformis subsp. coryniformis* [AL] Abo-Elnaga and Kandler 1965 - 34 | ATCC 25602 | DSM 20001, M58813, L.corynifo | NCIB 9711

*Lactobacillus coryniformis subsp. torquens* [AL] Abo-Elnaga and Kandler 1965 - 30 | ATCC 25600 | CECT 4129, AJ575741 | DSM 20004 | NCIB 9712

*Lactobacillus crispatus* [AL] (Brygoo and Aladame 1953) Moore and Holdeman 1970 - ATCC 33820 | DSM 20584, Y17362, L.crispat2 | VPI 3199

*Lactobacillus curvatus subsp. curvatus* [AL] (Troili-Petersson 1903) Abo-Elnaga and Kandler 1965 emend. Klein et al. 1996 - 1 | ATCC 25601 | DSM 20019 | NCIB 9710

*Lactobacillus curvatus subsp. melibiosus* [VP] Torriani et al. 1996 - R 60 | CCUG 34545, AY204889

*Lactobacillus cypricasei* [VP] Lawson et al. 2001 - LMK3, AJ251560 | CCUG 42961 | CIP 106393

*Lactobacillus diolivorans* [VP] Krooneman et al. 2002 - JKD6, AF264701 | DSM 14421 | LMG 19667

†*Lactobacillus divergens* [VP] Holzapfel and Gerber 1984 -> *Carnobacterium divergens* - 66 | ATCC 35677 | DSM 20623, M58816, Crn.diverg | NCDO 2763

*Lactobacillus durianis* [VP] Leisner et al. 2002 - CCUG 45405 | LMG 19193, AJ315640

*Lactobacillus equi* [VP] Morotomi et al. 2002 - YIT 0455, AB048833 | ATCC BAA-261 | JCM 10991

*Lactobacillus farciminis* [VP] Reuter 1983 - Rv4 | ATCC 29644, M58817, L.farcimin | DSM 20184 | IMET 11462 | NCIB 11717

*Lactobacillus ferintoshensis* [VP] Simpson et al. 2002 [411] - R7-84, AF275311 | CIP 106749

*Lactobacillus fermentum* [AL] Beijerinck 1901 - Bb28 | ATCC 14931, M58819, L.fermentm | DSM 20052 | NCDO 1750, X61142, L.fermentl

*Lactobacillus fornicalis* [VP] Dicks et al. 2000 - TV 1018, Y18654 | ATCC 70934 | DSM 13171

*Lactobacillus fructivorans* [AL] Charlton et al. 1934 - ATCC 8288 | DSM 20203, M58818, L.fructivo | DSM 20203, X76330, L.fructiv2 | IMET 11463 | NCIB 8039

†*Lactobacillus fructosus* [AL] Kodama 1956 -> *Leuconostoc fructosum* - 353 | ATCC 13162 | DSM 20349 | NBRC 3516 | NCDO 2345, X61140, L.fructosu | NCINMB 10784

*Lactobacillus frumenti* [VP] Müller et al. 2000 - TMW 1.666, AJ250074 | DSM 13145 | LMG 19473

*Lactobacillus fuchuensis* [VP] Sakala et al. 2002 - B5M10, AB063479 | JCM 11249 | DSM 14340

*Lactobacillus gallinarum* [VP] Fujisawa et al. 1992 - ATCC 33199, AJ242968 | DSM 10532 | NCFB 2235 | VPI 1294

*Lactobacillus gasseri* [VP] Lauer and Kandler 1980 - 63 AM | ATCC 33323 | DSM 20243, M58820, L.gasseri | NCDO 2233, X61137, L.gasseri1 | NCIB 11718

*Lactobacillus graminis* [VP] Beck et al. 1989 - G90 (1) | ATCC 51150 | CIP 105164 | DSM 20719 | NCIB 12808

†*Lactobacillus halotolerans* [VP] Kandler et al. 1983 -> *Weissella halotolerans* - G1 | R61 | ATCC 35410 | DSM 20190, M23037, Wei.haltol

*Lactobacillus hamsteri* [VP] Mitsuoka and Fujisawa 1988 - Ha5F1 | ATCC 4385 | | DSM 5661, AJ306298 | JCM 6256

*Lactobacillus helveticus* [AL] (Orla-Jensen 1919) Bergey et al. 1925 - Lh12 | ATCC 15009 | DSM 20075 | IMET 10709 | NCDO 2712, X61141, L.helvetic

*Lactobacillus heterohiochii* [AL] Kitahara et al. 1957 - ATCC 15435

*Lactobacillus hilgardii* [AL] Douglas and Cruess 1936 - 9 | ATCC 8290 | DSM 20176, M58821, L.hilgardi | NCDO 264 | NCIB 8040

*Lactobacillus homohiochii* [AL] Kitahara et al. 1957 - H42 | ATCC 15434 | DSM 20571 | JCM 1199

*Lactobacillus iners* [VP] Falsen et al. 1999 - CCUG 28746, Y16329

*Lactobacillus ingluviei* [VP] Baele et al. 2003 - KR3, AF333975 | CCUG 45722 | LMG 20380

*Lactobacillus intestinalis* [VP] (ex Hemme 1974) Fujisawa et al. 1990 - Th4 | ATCC 49335 | DSM 6629, AJ306299 | JCM 7548

*Lactobacillus jensenii* [AL] Gasser et al. 1970 - 62G | ATCC 25258, AF243176 | DSM 20557

*Lactobacillus johnsonii* [VP] Fujisawa et al. 1992 - ATCC 33200, AJ002515, L.johnsoni | DSM 10533 | NCFB 2241 | VPI 7960

†*Lactobacillus kandleri* [VP] Holzapfel and van Wyk 1983 -> *Weissella kandleri* - L250 | ATCC 51149 | DSM 20593, M23038, Wei.kandlr | NCFB 2753

†*Lactobacillus kefiranofaciens* [VP] Fujisawa et al. 1988 - WT-2B | ATCC 43761 | DSM 5016 | JCM 6985 | LMG 19149, AJ575259

*Lactobacillus kefiranofaciens subsp. kefiranofaciens* [VP] (Fujisawa et al. 1988) Vancanneyt et al. 2004 <- *Lactobacillus kefiranofaciens* (basonym) - LMG 19149, AJ575259 | R-14703, AJ575260

*Lactobacillus kefiranofaciens subsp. kefirgranum* [VP] (Takizawa et al. 1994) Vancanneyt et al. 2004 <- *Lactobacillus kefirgranum* (basonym) - LMG 15132, AJ575261 | R-12929, AJ575262

†*Lactobacillus kefirgranum* [VP] Takizawa et al. 1994 -> - GCL 1701 | DSM 10550 | JCM 8572

[411] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

[412] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

*Lactobacillus kefiri* [VP] Kandler and Kunath 1983 - A/K | ATCC 35411 | DSM 20587
*Lactobacillus kimchii* [VP] Yoon et al. 2000 - MT-1077, AF183558 | JCM 10707 | KCTC 8903P
*Lactobacillus kitasatonis* [VP] Mukai et al. 2003 - JCM 1039, AB107638 | KCTC 3155
*Lactobacillus kunkeei* [VP] Edwards et al. 1998 - YH-15, Y11374 | ATCC 700308 | DSM 12361
†*Lactobacillus lactis* [AL] (Orla-Jensen 1919) Bergey et al. 1934 -> *Lactobacillus delbrueckii subsp. lactis* - ATCC 12315 | DSM 20072, M58823, L.delbruc4
*Lactobacillus leichmannii* [AL] (Henneberg 1903) Bergey et al. 1923 - ATCC 4797
*Lactobacillus lindneri* [VP] Back et al. 1997 - KPA | DSM 20690, X95421, L.lindneri
*Lactobacillus malefermentans* [VP] Farrow et al. 1989 - D2 MF1 | ATCC 49373 | DSM 5705 | NCDO 1410
*Lactobacillus mali* [AL] Carr and Davies 1970 = *Lactobacillus yamanashiensis mali* (junior homotypic synonym) = *Lactobacillus yamanashiensis yamanashiensis* (junior heterotypic synonym) -> *Lactobacillus yamanashiensis mali* - J12 | ATCC 27053 | DSM 20444, M58824, L.mali | NCIB 10560
*Lactobacillus maltaromicus* [AL] Miller et al. 1974 - MX 5 | ATCC 27865 | DSM 20342, M58825, L.maltarom | JCM 1154, X54420, L.maltaro2 | LMG 6903
*Lactobacillus manihotivorans* [VP] Morlon-Guyot et al. 1998 - OND 32, AF000162, L.manihotv | LMG 18010
*Lactobacillus mindensis* [VP] Ehrmann et al. 2003 - TMW 1.80, AJ313530 | DSM 14500 | LMG 21508
†*Lactobacillus minor* [VP] Kandler et al. 1983 -> *Weissella minor* - 3 | ATCC 35412 | DSM 20014, M23039, Wei.minor
†*Lactobacillus minutus* [AL] (Hauduroy et al. 1937) Moore and Holdeman 1972 -> *Atopobium minutum* - ATCC 33267 | DSM 20586 | VPI 9428
*Lactobacillus mucosae* [VP] Roos et al. 2000 - S32, AF126738
*Lactobacillus murinus* [VP] Hemme et al. 1982 - 313 | ATCC 35020 | CNRZ 220 | DSM 20452, M58826, L.murinus
*Lactobacillus nageli* [VP] Edwards et al. 2000 - LuE10 | ATCC 700692, Y17500
*Lactobacillus oris* [VP] Farrow and Collins 1988 - 5A1 | ATCC 49062 | DSM 4864, X94229, L.oris2 | NCDO 2160, X61131, L.oris | NCIB 8831
*Lactobacillus panis* [VP] Wiese et al. 1996 - ST1 | DSM 6035, X94230, L.panis1
*Lactobacillus pantheris* [VP] Liu and Dong 2002 - A24-2-1 | AS 1.2826 | LMG 21017, AF413523
*Lactobacillus parabuchneri* [VP] Farrow et al. 1989 - ATCC 49374 | DSM 5707 | LMG 11457 , AY026751 | NCDO 2748 | NCIB 8838
*Lactobacillus paracasei subsp. paracasei* [VP] Collins et al. 1989 = *Lactobacillus casei subsp. alactosus* (junior heterotypic synonym) = *Lactobacillus casei subsp. pseudoplantarum* (junior heterotypic synonym) - RO94 | ATCC 25302 | DSM 5622 | NBRC 15889 | JCM 8130, D79212, L.prcasei | NCDO 151
*Lactobacillus paracasei subsp. tolerans* [VP] (Abo-Elnaga and Kandler 1965) Collins et al. 1989 <- *Lactobacillus casei subsp. tolerans* (basonym) - 27211 | ATCC 25599 | DSM 20258 | JCM 1171, D16550, L.prcas_to | NCFB 2774 | NCIB 9709
*Lactobacillus paracollinoides* [VP] Suzuki et al. 2004 - LA2, E16651 | DSM 15502 | JCM 11969
*Lactobacillus parakefiri* [VP] Takizawa et al. 1994 - GCL 1731 | DSM 10551 | LMG 15133, AY026750 | NBRC 15890 | JCM 8573
*Lactobacillus paralimentarius* [VP] Cai et al. 1999 - TB 1, AB018528 | DSM 13238, AJ417500 | JCM 10415
*Lactobacillus paraplantarum* [VP] Curk et al. 1996 - CST 10961 | CIP 104668 | CNRZ 1885 | DSM 10667, AJ306297, AJ306297
*Lactobacillus pentosus* [VP] Zanoni et al. 1987 - 124-2 | ATCC 8041 | DSM 20314 | JCM 1558, D79211 | NCDO 363 | NCIB 8026
*Lactobacillus perolens* [VP] Back et al. 2000 - L 532, Y19167 | LMG 18936 | DSM 12744

†*Lactobacillus piscicola* [VP] Hiu et al. 1984 -> *Carnobacterium piscicola* - B270 = *Lactobacillus carnis* (junior heterotypic synonym) | ATCC 35586 | DSM 20730 | NCDO 2762

*Lactobacillus plantarum* [AL] (Orla-Jensen 1919) Bergey et al. 1923 - Lp 39 | ATCC 14917 | DSM 20174 | JCM 1149, D79210, L.plantar3 | LMG 6907 | NCDO 1752, X52653, L.plantar2

*Lactobacillus pontis* [VP] Vogel et al. 1994 - LTH 2587, X76329, L.pontis | DSM 8475 | LMG 14187

*Lactobacillus psittaci* [VP] Lawson et al. 2001 - CCUG 42378, AJ272391 | CIP 106492

*Lactobacillus reuteri* [VP] Kandler et al. 1982 - F 275 | ATCC 23272 | DSM 20016, L23507, L.reuteri | DSM 20016, X76328, L.reuteri3

*Lactobacillus rhamnosus* [VP] (Hansen 1968) Collins et al. 1989 <- *Lactobacillus casei subsp. rhamnosus* (basonym) - ATCC 7469 | CCM 1825 | DSM 20021, M58815, L.rhamnosu | NCDO 243 | NCIB 6375

†*Lactobacillus rimae* [VP] Olsen et al. 1991 -> *Atopobium rimae* - ATCC 49626, AF292371 | DSM 7090 | VPI D140H-11A

*Lactobacillus rogosae* [AL] Holdeman and Moore 1974 - VPI C37-38

*Lactobacillus ruminis* [AL] Sharpe et al. 1973 - RF1 | ATCC 27780 | DSM 20403, M58828, L.ruminis

*Lactobacillus sakei subsp. sakei* [AL] Katagiri et al. 1934 emend. Klein et al. 1996 = *Lactobacillus bavaricus* (junior heterotypic synonym) - ATCC 15521 | DSM 20017, M58829, L.sakeisak

*Lactobacillus sakei subsp. carnosus* [VP] Torriani et al. 1996 - R 14b/a | CCUG 31331, AY204892

*Lactobacillus salivarius subsp. salivarius* [AL] Rogosa et al. 1953 - ATCC 11741, AF089108, L.salivar2 | DSM 20555 | H066 | NCDO 929

*Lactobacillus salivarius subsp. salicinius* [AL] Rogosa et al. 1953 - ATCC 11742 | DSM 20554, M59054, L.salivari | HO268 | NCDO 1555

*Lactobacillus sanfranciscensis* [VP] Weiss and Schillinger 1984 - L-12 | ATCC 27651, X76327, L.sanfran2 | DSM 20451 | NRRL B-3934

*Lactobacillus sharpeae* [VP] Weiss et al. 1982 - 71 | ATCC 49974 | DSM 20505, M58831, L.sharpeae | JCM 1186 | NCDO 2590 | NCIB 11720

*Lactobacillus suebicus* [VP] Kleynmans et al. 1989 - I | ATCC 49375 | CCUG 32233, AJ306403 | DSM 5007

*Lactobacillus thermotolerans* [VP] Niamsup et al. 2003 - G35, AF317702 | DSM 14792 | JCM 11425

*Lactobacillus trichodes* [AL] Fornachon et al. 1949 - ATCC 27394

†*Lactobacillus uli* [VP] Olsen et al. 1991 -> *Olsenella uli* - ATCC 49627, AY005814, AF292373 | DSM 7084 | VPI D76D-27C

*Lactobacillus vaccinostercus* [VP] Kozaki and Okada 1983 - TUA 055B | X-94 | ATCC 33310 | DSM 20634

*Lactobacillus vaginalis* [VP] Embley et al. 1989 - ATCC 49540 | DSM 5837 | Lac 19 | NCTC 12197, X61136, L.vaginali

*Lactobacillus versmoldensis* [VP] Kröckel et al. 2003 - KU-3, AJ496791 | ATCC BAA-478 | DSM 14857 | NCCB 100034

†*Lactobacillus viridescens* [AL] Niven and Evans 1957 -> *Weissella viridescens* - S38A | ATCC 12706 | CCM 56 | DSM 20410, M23040, Wei.viride | NCDO 1655, X52568, Wei.virid1 | NCIB 8965

*Lactobacillus vitulinus* [AL] Sharpe et al. 1973 - RL 2 | ATCC 27783, M23727, L.vitulinu | DSM 20405, M23727, L.vitulinu | JCM 8228

†*Lactobacillus xylosus* [AL] Kitahara 1938 = *Lactococcus lactis subsp. lactis* (senior heterotypic synonym) - ATCC 15577

†*Lactobacillus yamanashiensis subsp. yamanashiensis* [VP] Nonomura 1983 = *Lactobacillus mali* (senior heterotypic synonym) - 239 | ATCC 27304

†*Lactobacillus yamanashiensis subsp. mali* [VP] Nonomura 1983 = *Lactobacillus mali* (senior homotypic synonym) - NCIB 10560

*Lactobacillus zeae* [VP] Dicks et al. 1996 - ATCC 15820, D86516, L.zeae1 | DSM 20178 | NCIB 9537 | RIA 482

*Genus II. Paralactobacillus* [VP]

*Paralactobacillus selangorensis* [VP (T)] Leisner et al. 2000 - LMG 17710, AF049745

*Genus III. Pediococcus* [AL]

*Pediococcus damnosus* [AL (T)] Claussen 1903 - Be.1 | ATCC 29358 | DSM 20331 | JCM 5886, D87678, Ped.damnos | LMG 11484 | NCDO 1832

*Pediococcus acidilactici* [AL] Lindner 1887 - B213c | DSM 20284, M58833, Ped.acidil

*Pediococcus claussenii* [VP] Dobson et al. 2002 - P06 | ATCC BAA-344 | DSM 14800

*Pediococcus dextrinicus* [AL] (Coster and White 1964) Back 1978 - L95 | ATCC 33087 | DSM 20335 | JCM 5887, D87679, Ped.dextrn | LMG 10649 | NCDO 1561

†*Pediococcus halophilus* [AL] Mees 1934 -> *Tetragenococcus halophilus* - TC 1 | ATCC 23315 | DSM 20339, AJ301843 | NCDO 1635

*Pediococcus inopinatus* [VP] Back 1988 - 236b | DSM 20285, AJ271383

*Pediococcus parvulus* [AL] Gunther and White 1961 - S182 | ATCC 19371 | DSM 20332 | JCM 5889, D88528, Ped.parvul | LMG 11486 | NCDO 1634 | NCIB 9447

*Pediococcus pentosaceus* [AL] Mees 1934 - ATCC 33316 | DSM 20336, M58834, Ped.pentos | NCDO 990

*Pediococcus urinaeequi* [VP] Garvie 1988 - ATCC 29723 | DSM 20341 | NCDO 1636

*Family II. "Aerococcaceae"*

*Genus I. Aerococcus* [AL]

*Aerococcus viridans* [AL (T)] Williams et al. 1953 - M1 | ATCC 11563, M58797, Aer.virida | CCM 1914 | DSM 20340 | IAM 13649 | IMET 11154 | NCDO 1225 | NCTC 8251

*Aerococcus christensenii* [VP] Collins et al. 1999 - CCUG 28831, Y17005

*Aerococcus sanguinicola* [VP] Lawson et al. 2001 - CCUG 43001, AJ276512 | CIP 106533

*Aerococcus urinae* [VP] Aguirre and Collins 1992 - DSM 7446 | NCFB 2893, M77819, Aer.urinae | NCTC 12142

*Aerococcus urinaehominis* [VP] Lawson et al. 2001 - CCUG 42038b, AJ278341 | CIP 106675

*Genus II. Abiotrophia* [VP]

*Abiotrophia defectiva* [VP (T)] (Bouvet et al. 1989) Kawamura et al. 1995 <- *Streptococcus defectivus* (basonym) - SC10 | ATCC 49176, D50541, Abt.defect | CIP 103242 | DSM 9849

†*Abiotrophia adiacens* [VP] (Bouvet et al. 1989) Kawamura et al. 1995 <- *Streptococcus adjacens* (basonym) -> *Granulicatella adiacens* - GaD | ATCC 49175, D50540, Abt.adiacn | CIP 103243 | DSM 9848

†*Abiotrophia balaenopterae* [VP] Lawson et al. 1999 -> *Granulicatella balaenopterae* - M1975/96/1 | CCUG 37380, Y16547, Abt.balaen

†*Abiotrophia elegans* [VP] Roggenkamp et al. 1999 -> *Granulicatella elegans* - B1333, AF016390, Abt.elegan | DSM 11693, AF016390, Abt.elegan

*Genus III. Dolosicoccus* [VP]

*Dolosicoccus paucivorans* [VP (T)] Collins et al. 1999 - 2992-95, AJ012666 | CCUG 39307

*Genus IV. Eremococcus* [VP]

*Eremococcus coleocola* [VP (T)] Collins et al. 1999 - M1832/95/2 | CCUG 38207, Y17780

*Genus V. Facklamia* [VP]

*Facklamia hominis* [VP (T)] Collins et al. 1997 - CCUG 36813 | CCUG 36813, Y10772, Fac.homini

*Facklamia ignava* [VP] Collins et al. 1998 - 164-97, Y15716 | CCUG 37419 | CIP 105583

*Facklamia languida* [VP] Lawson et al. 1999 - 1144-97, Y18053 | CCUG 37842

*Facklamia miroungae* [VP] Hoyles et al. 2001 - A/G13/99/2 | CCUG 42728, AJ277381 [413] | CIP 106764

[413] GenBank accession number not currently valid.

*Facklamia sourekii* VP Collins et al. 1999 - STR 2/84 | CCUG 28783A, Y17312, Fac.sourek

*Facklamia tabacinasalis* VP Collins et al. 1999 - CCUG 30090, Y17820

*Genus VI. Globicatella* VP

*Globicatella sanguinis* VP (T) Collins et al. 1995 - 1152-78 | ATCC 51173 | DSM 7447 | NCFB 2835

*Globicatella sulfidifaciens* VP Vandamme et al. 2001 - GEM 604 | CCUG 44365 | LMG 18844, AJ297627

*Genus VII. Ignavigranum* VP

*Ignavigranum ruoffiae* VP (T) Collins et al. 1999 - CCUG 37658, Y16426, Ig.ruoffia

*Family III. Carnobacteriaceae*

*Genus I. Carnobacterium* VP

*Carnobacterium divergens* VP (T) (Holzapfel and Gerber 1983) Collins et al. 1987 <- *Lactobacillus divergens* (basonym) - 66 | ATCC 35677 | DSM 20623, M58816, Crn.diverg | NCDO 2763, X54270, Crn.diver1

*Carnobacterium alterfunditum* VP Franzmann et al. 1993 - pf4 | ACAM 313 | ATCC 49837 | DSM 5972

*Carnobacterium funditum* VP Franzmann et al. 1993 - pf3, S86170, Crn.fundit | ACAM 312 | ATCC 49836 | DSM 5970, S86170, Crn.fundit

*Carnobacterium gallinarum* VP Collins et al. 1987 - MT44 | ATCC 49517 | DSM 4847 | NCFB 2766, X54269, Crn.gallin

*Carnobacterium inhibens* VP Jöborn et al. 1999 - K1, Z73313 | CCUG 31728

*Carnobacterium maltaromaticum* VP (Miller et al. 1974) Mora et al. 2003 <- *Carnobacterium piscicola* (basonym) - ATCC 27865 | CCUG 30142 | CIP 103135 | DSM 20342 | JCM 1154, X54420 | LMG 6903 | NRRL B-14852

*Carnobacterium mobile* VP Collins et al. 1987 - MT37L | ATCC 40516 | DSM 4848 | NCFB 2765, X54271, Crn.mobile

†*Carnobacterium piscicola* VP (Hiu et al. 1984) Collins et al. 1987 <- *Lactobacillus piscicola* (basonym) -> *Carnobacterium piscicola* - B270 | ATCC 35586 | DSM 20730 | NCDO 2762, X54268, Crn.pisci1

*Carnobacterium viridans* VP Holley et al. 2002 - MPL-11, AF425608 | ATCC BAA-336 | DSM 14451

*Genus II. Agitococcus* VP

*Agitococcus lubricus* VP (T) Franzmann and Skerman 1981 - DSM 5822 | UQM 1981

*Genus III. Alkalibacterium* VP

*Alkalibacterium olivapovliticus* VP (T) Ntougias and Russel 2001 - WW2–SN4a, AF143511 | DSM 13175 | NCIMB 13710

*Genus IV. Allofustis* VP

*Allofustis seminis* VP (T) Collins et al. 2003 - 01-570-1 | CCUG 45438, AJ410303 | CIP 107425

*Genus V. Alloiococcus* VP

*Alloiococcus otitis* VP (T) Aguirre and Collins 1992 - 7760 | DSM 7252 | NCFB 2890, X59765, Aic.otitis

*Genus VI. Desemzia* VP

*Desemzia incerta* VP (T) (Steinhaus 1941) Stackebrandt et al. 1999 <- *Brevibacterium incertum* (basonym) - ATCC 8363 | DSM 20581, Y14650, Dsz.incert | IMET 11374 | NCIB 9892

*Genus VII. Dolosigranulum* VP

*Dolosigranulum pigrum* VP (T) Aguirre et al. 1994 - R91/1468 | NCFB 2975, X70907, Dol.pigrum

*Genus VIII. Granulicatella* VP

*Granulicatella adiacens* VP (T) (Bouvet et al. 1989) Collins and Lawson 2000 <- *Abiotrophia adiacens* (basonym) - GaD | ATCC 49175, D50540 | CIP 103243 | DSM 9848

*Granulicatella balaenopterae* [VP] (Lawson et al. 1999) Collins and Lawson 2000 <- *Abiotrophia balaenopterae* (basonym) - M1975/96/1 | CCUG 37380, Y16547

*Granulicatella elegans* [VP] (Roggenkamp et al. 1999) Collins and Lawson 2000 <- *Abiotrophia elegans* (basonym) - B1333, AF016390 | DSM 11693

*Genus IX. Isobaculum* [VP]

*Isobaculum melis* [VP (T)] Collins et al. 2002 - M577-94 | CCUG 37660, AJ302648 | DSM 13760

*Genus X. Lactosphaera* [VP 414]

†*Lactosphaera pasteurii* [VP (T)] (Schink 1985) Janssen et al. 1995 <- *Ruminococcus pasteurii* (basonym) -> *Trichococcus pasteurii* - KoTa2, X87150, Lcs.paster | ATCC 35945 | DSM 2381, L76599, Lcs.paste2

*Genus XI. Marinilactibacillus* [VP]

*Marinilactibacillus psychrotolerans* [VP (T)] Ishikawa et al. 2003 - M13-2, AB083406 | IAM 14980 | NBRC 100002 | NCIMB 13873 | NRIC 0510

*Genus XII. Trichococcus* [VP]

*Trichococcus flocculiformis* [VP (T)] Scheff et al. 1984 - Echt, Y17301 | ATCC 51221 | DSM 2094

*Trichococcus palustris* [VP] (Zhilina et al. 1997) Jian-Rong et al. 2002 <- *Ruminococcus palustris* (basonym) - Z-7189 | DSM 9172, AJ296179

*Trichococcus pasteurii* [VP (T)] (Schink 1985) Jian-Rong et al. 2002 <- *Lactosphaera pasteurii* (basonym) - KoTa2, X87150, Lcs.paster | ATCC 35945 | DSM 2381, L76599, Lcs.paste2

*Family IV. "Enterococcaceae"*

*Genus I. Enterococcus* [VP]

*Enterococcus faecalis* [VP (T)] (Andrewes and Horder 1906) Schleifer and Kilpper-Bälz 1984 <- *Streptococcus faecalis* (basonym) - ATCC 19433 | DSM 20478 | JCM 5803, AB012212, Eco.faeca1 | NCDO 581 | NCIB 775 | NCTC 775

*Enterococcus asini* [VP] de Vaux et al. 1998 - AS2, Y11621, Eco.asini1 | DSM 11492

*Enterococcus avium* [VP] Collins et al. 1984 - Guthof E6844 | ATCC 14025 | CIP 103019, AF133535 | DSM 20679 | IMET 3257 | LMG 10744, AJ301825 | NCDO 2369 | NCTC 9938

*Enterococcus canis* [VP] De Graef et al. 2003 - CCUG 46666 | LMG 12316, X76177

*Enterococcus casseliflavus* [VP] Collins et al. 1984 <- *Streptococcus casseliflavus* (basonym) - MUTK 20, Y18161 | ATCC 25788 | CCM 2478 | DSM 20680 | NCDO 2372 | NCIB 11449

*Enterococcus cecorum* [VP] (Devriese et al. 1983) Williams et al. 1989 <- *Streptococcus cecorum* (basonym) - A60, Y18355, AF061009 | ATCC 43198 | DSM 20682 | NCDO 2674

*Enterococcus columbae* [VP] Devriese et al. 1993 - STR 345, X56422, Eco.columb | ATCC 51263 | DSM 7374 | NCIMB 13013, X56422, Eco.columb

*Enterococcus dispar* [VP] Collins et al. 1991 - E18-1, Y18358, AF061007 | ATCC 51266 | DSM 6630 | NCFB 2821 | NCIMB 13000

*Enterococcus durans* [VP] Collins et al. 1984 = *Streptococcus durans* (junior homotypic synonym) - 98D | ATCC 19432 | CCM 5612 | CECT 411, AJ420801 | DSM 20633, AJ276354 | NCDO 596 | NCTC 8307

*Enterococcus faecium* [VP] (Orla-Jensen 1919) Schleifer and Kilpper-Bälz 1984 <- *Streptococcus faecium* (basonym) - ATCC 19434 | DSM 20477, AJ276355 | JCM 5804, AB012213, Eco.faeci3 | NCDO 942 | NCTC 7171

*Enterococcus flavescens* [VP] Pompei et al. 1992 - CA 2 | ATCC 49996 | CCM 4239, | CCUG 30567 | DSM 7370 | LMG 13518, AJ301832

*Enterococcus gallinarum* [VP] (Bridge and Sneath 1982) Collins et al. 1984 <- *Streptococcus gallinarum* (basonym) - F87/276 | PB21 | ATCC 35038 | CCUG 18658 | CECT 970, AJ420805 | DSM 20628 | LMG 13129, AJ301833 | NCDO 2313 | NCTC 11428

[414] Rule 37a(1) states that the name of a taxon must be changed if the nomenclatural type of the taxon is excluded.

*Enterococcus gilvus* [VP] Turrell et al. 2002 - PQ1, AY033814 | ATCC BAA-350 | CCUG 45553

*Enterococcus haemoperoxidus* [VP] Svec et al. 2001 - 440 | CCM 4851, AF286832 | LMG 19487

*Enterococcus hirae* [VP] Farrow and Collins 1985 - R | ATCC 8043 | CCM 2423 | CCM 2424 | DSM 20160, AJ276356, Y17302 | IMET 11742 | NCDO 1258 | NCFB 1258, Y18354 | NCIB 6459

*Enterococcus malodoratus* [VP] Collins et al. 1984 - ATCC 43197, Y18339, AF061012 | DSM 20681 | NCDO 846

*Enterococcus moraviensis* [VP] Svec et al. 2001 - 330 | CCM 4856, AF286831 | LMG 19486

*Enterococcus mundtii* [VP] Collins et al. 1986 - MUTK 559, Y18340, AF061013 | ATCC 43186 | DSM 4838 | NCDO 2375

*Enterococcus pallens* [VP] Turrell et al. 2002 - PQ2, AY033815 | ATCC BAA-351 | CCUG 45554

*Enterococcus phoeniculicola* [VP] Law-Brown and Meyers 2003 - JLB-1, AY028437 | ATCC BAA-412 | DSM 14726

*Enterococcus porcinus* [VP] Teixeira et al. 2001 - DS 1390–83 | ATCC 700913, AF335596 | CCUG 43229 | NCIMB 13634

*Enterococcus pseudoavium* [VP] Collins et al. 1989 - 47-16, Y18356, AF061002 | ATCC 49372 | DSM 5632 | NCDO 2138

*Enterococcus raffinosus* [VP] Collins et al. 1989 - 1789/79 | ATCC 49427 | DSM 5633 | NCIMB 12901, Y18296 | NCTC 12192

*Enterococcus ratti* [VP] Teixeira et al. 2001 - DS 2705–87, AF326472 [415] | ATCC 700914 | CCUG 43228 | NCIMB 13635

*Enterococcus saccharolyticus* [VP] (Farrow et al. 1985) Rodrigues and Collins 1991 <- *Streptococcus saccharolyticus* (basonym) - HF 62 | ATCC 43076 | DSM 20726 | NCDO 2594, X55767, Eco.saclyt

†*Enterococcus seriolicida* [VP] Kusuda et al. 1991 = *Lactococcus garvieae* (senior heterotypic synonym) - YT-3, L32813, Lcc.garvi2 | ATCC 49156 | DSM 6783

*Enterococcus solitarius* [VP] Collins et al. 1989 - 885/78 | ATCC 49428, AF061010 | DSM 5634, AJ301840 | NCTC 12193

*Enterococcus sulfureus* [VP] Martinez-Murcia and Collins 1991 - MUTK 31, X55133, Eco.sulfur | NCDO 2379, X55133, Eco.sulfur

*Enterococcus villorum* [VP] Vancanneyt et al. 2001 [416] - 88-5474 | CCM 4887 | LMG 12287, AJ271329

*Genus II. Atopobacter* [VP]

*Atopobacter phocae* [VP (T)] Lawson et al. 2000 - M1590/94/2, Y16546 | CCUG 42358 | CIP 106392

*Genus III. Melissococcus* [VP]

*Melissococcus plutonius* [VP (T)] Bailey and Collins 1983 - NCDO 2443, X75751, Mlsc.plutn

*Genus IV. Tetragenococcus* [VP]

*Tetragenococcus halophilus* [VP (T)] (Mees 1934) Collins et al. 1993 <- *Pediococcus halophilus* (basonym) - TC 1 | ATCC 33315 | DSM 20339, AJ301843 | IAM 12284 | IAM 1676, D88668, Tgc.halop2 | JCM 5888, D87680, Tgc.haloph | NCDO 1635

*Tetragenococcus muriaticus* [VP] (Mees 1934) Collins et al. 1993 - X-1 | JCM 10006, D88824

*Genus V. Vagococcus* [VP]

*Vagococcus fluvialis* [VP (T)] Collins et al. 1990 - M-29C | ATCC 49515 | CCUG 32704, Y18098 | DSM 5731 | NCDO 2497, X54258, Vag.fluvia

*Vagococcus fessus* [VP] Hoyles et al. 2000 - M2661/98/1, AJ243326 | CCUG 41755

*Vagococcus lutrae* [VP] Lawson et al. 1999 - CCUG 39187, Y17152

[415] GenBank accession number not currently valid.

[416] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

*Vagococcus salmoninarum* [VP] Wallbanks et al. 1990 - OS1-68 | ATCC 51200 | DSM 6633 | NCFB 2777, X54272, Vag.salmon

*Family V.* "*Leuconostocaceae*"

*Genus I. Leuconostoc* [AL]

*Leuconostoc mesenteroides subsp. mesenteroides* [AL (T)] (Tsenkovskii 1878) van Tieghem 1878 - 37 Y | ATCC 8293 | CCM 1803 | DSM 20343, M23035, Lc.mesente | NCDO 523, X95978, Lc.mesent2 | NCIB 8023

*Leuconostoc inhae* [VP] Kim et al. 2003 - IH003, AF439560 | DSM 15101 | KCTC 3774

*Leuconostoc mesenteroides subsp. cremoris* [VP] (Knudsen and Sörensen 1929) Garvie 1983 <- *Leuconostoc cremoris* (basonym) - ATCC 19254 | CCM 2078 | DSM 20346 | IMET 10694 | NCDO 543

*Leuconostoc mesenteroides subsp. dextranicum* [VP] (Beijerinck 1912) Garvie 1983 <- *Leuconostoc dextranicum* (basonym) - ATCC 19255 | CCM 2086 | DSM 20484 | NCDO 529 | NRRL B-3469

†*Leuconostoc amelibiosum* [VP] Schillinger et al. 1989 = *Leuconostoc citreum* (senior heterotypic synonym) - ATCC 13146 | DSM 20188 | NRRL B-742

*Leuconostoc argentinum* [VP] Dicks et al. 1993 - DSM 8581, AF175403 | LL76

*Leuconostoc carnosum* [VP] Shaw and Harding 1989 - SML40 | ATCC 49367 | DSM 5576 | NCFB 2776, X95977, Lc.carnosu

*Leuconostoc citreum* [VP] Farrow et al. 1989 = *Leuconostoc amelibiosum* (junior heterotypic synonym) - B2399 | ATCC 49730 | DSM 5577 | NCDO 1837

†*Leuconostoc cremoris* [AL] (Knudsen and Sörenson 1929) Garvie 1960 -> *Leuconostoc mesenteroides subsp. cremoris* - LF2 | ATCC 19254 | CCM 2078 | DSM 20346, M23034, Lc.mesencr | IMET 10693 | NCDO 543

†*Leuconostoc dextranicum* [AL] (Beijerinck 1912) Hucker and Pederson 1930 -> *Leuconostoc mesenteroides subsp. dextranicum* - DSM 20484 | IMET 10694 | NCDO 529

*Leuconostoc fallax* [VP] Martinez-Murcia and Collins 1992 - DSM 20189, S63851, Lc.fallax

*Leuconostoc ficulneum* [VP] Antunes et al. 2002 - FS-1, AF360736 | DSM 13613 | NRRL B-23447

*Leuconostoc fructosum* [VP] (Kodama 1956) Antunes et al. 2002 <- *Lactobacillus fructosus* (basonym) - ATCC 13162 | DSM 20349, AF360737 | NBRC 3516 | NCDO 2345, X61140, L.fructosu | NCIMB 10784

*Leuconostoc gasicomitatum* [VP] Björkroth et al. 2001 [417] - TB 1-10 | LMG 18811, AF231131

*Leuconostoc gelidum* [VP] Shaw and Harding 1989 - SML9 | ATCC 49366 | DSM 5578, AF175402 | NCFB 2775

*Leuconostoc kimchii* [VP] Kim et al. 2000 - IH25, AF173986 | IMSNU 11154 | KCTC 2386

*Leuconostoc lactis* [AL] Garvie 1960 - ATCC 19256 | DSM 20202, M23031, Lc.lactis | NCDO 533

†*Leuconostoc oeni* [AL] Garvie 1967 -> *Oenococcus oeni* - ATCC 23279 | DSM 20252, M35820, Occ.oeni2 | NCDO 1674, X95980, Occ.oeni1

†*Leuconostoc paramesenteroides* [AL] Garvie 1967 -> *Weissella paramesenteroides* - R 80 | ATCC 33313 | DSM 20288, M23033, Wei.pmesen | IMET 10704 | NCDO 803, X95982, Wei.pmese2

*Leuconostoc pseudomesenteroides* [VP] Farrow et al. 1989 - 39 | ATCC 12291 | CCM 2083 | DSM 20193 | DSM 284 | NCDO 768, X95979, Lc.pmesent | NCIB 8699

*Genus II. Oenococcus* [VP]

*Oenococcus oeni* [VP (T)] (Garvie 1967) Dicks et al. 1995 <- *Leuconostoc oeni* (basonym) - Baudry 1 | ATCC 23179 | DSM 20252, M35820, Occ.oeni2 | NCDO 1674, X95980, Occ.oeni1

*Genus III. Weissella* [VP]

[417] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

*Weissella viridescens* [VP (T)] (Niven and Evans 1957) Collins et al. 1994 <- *Lactobacillus viridescens* (basonym) - S38A | ATCC 12706 | CCM 56 | DSM 20410, M23040, Wei.viride | NCDO 1655, X52568, Wei.virid1 | NCIB 8965

*Weissella cibaria* [VP] Björkroth et al. 2002 = *Weissella kimchii* (junior heterotypic synonym) - II-I-59 | CCUG 41967 | LMG 17699, AJ295989

*Weissella confusa* [VP] (Holzapfel and Kandler 1969) Collins et al. 1994 <- *Lactobacillus confusus* (basonym) - 548-D | ATCC 10881 | DSM 20196, M23036, Wei.confus | NCDO 1586, X52567, Wei.confu2 | NCIB 9311

*Weissella halotolerans* [VP] (Kandler et al. 1983) Collins et al. 1994 <- *Lactobacillus halotolerans* (basonym) - G1 | R61 | ATCC 35410 | DSM 20190, M23037, Wei.haltol

*Weissella hellenica* [VP] Collins et al. 1994 - LV346 | ATCC 51523 | DSM 7378 | NCFB 2973, X95981, Wei.helle2

*Weissella kandleri* [VP] (Holzapfel and van Wyk 1983) Collins et al. 1994 <- *Lactobacillus kandleri* (basonym) - L250 | ATCC 51149 | DSM 20593, M23038, Wei.kandlr | NCFB 2753

*Weissella kimchii* [VP] (Choi et al. 2002) emend. Ennahar and Cai 2004 = *Weissella cibaria* (senior heterotypic synonym) - CHJ3, AF312874 | DSM 14295 | KCTC 3746 | KCCM 41287

*Weissella koreensis* [VP] Lee et al. 2002 - S-5623 | KCTC3621 | KCCM 41516 | JCM 11263, AY035891

*Weissella minor* [VP] (Kandler et al. 1983) Collins et al. 1994 <- *Lactobacillus minor* (basonym) - 3 | ATCC 35412 | DSM 20014, M23039, Wei.minor

*Weissella paramesenteroides* [VP] (Garvie 1967) Collins et al. 1994 <- *Leuconostoc paramesenteroides* (basonym) - R 80 | ATCC 33313 | DSM 20288, M23033, Wei.pmesen | IMET 10704 | NCDO 803, X95982, Wei.pmese2

*Weissella soli* [VP] Magnusson et al. 2002 - Mi268, AY028260 | DSM 14420 | LMG 20113

*Weissella thailandensis* [VP] Tanasupawat et al. 2000 - FS61-1, AB023838 | PCU 210 | NRIC 0298 | HSCC 1412 | JCM10695 | TISTR 1384

*Family VI. Streptococcaceae* [AL]

*Genus I. Streptococcus* [AL (T)]

*Streptococcus pyogenes* [AL (T)] Rosenbach 1884 - SF 130 | T1 | ATCC 12344, AB002521, Stc.pyoge3 | DSM 20565 | IMET 3002 | NCTC 8198

*Streptococcus acidominimus* [AL] Ayers and Mudge 1922 - ATCC 51725 | CCUG 27296 | DSM 20622 | NCDO 2025 | NCDO 2025, X58301, Stc.acidom

†*Streptococcus adjacens* [VP] Bouvet et al. 1989 -> *Abiotrophia adiacens* - GaD | ATCC 49175, D50540, Abt.adiacn | CIP 103243 | DSM 9848

*Streptococcus agalactiae* [AL] Lehmann and Neumann 1896 - G 19 | ATCC 13813, AB002479, Stc.agala4 | DSM 2134 | NCDO 1348, X59032, Stc.agalac | NCTC 8181, AB002479, Stc.agala4

*Streptococcus alactolyticus* [VP] Farrow et al. 1985 = *Streptococcus intestinalis* (junior heterotypic synonym) - GP2 | ATCC 43077 | DSM 20728 | NCDO 1091, X58319, Stc.alacto

*Streptococcus anginosus* [AL] Andrewes and Horder 1906 emend. Whiley and Beighton 1991 - Havill III | ATCC 12395 | ATCC 33397 | DSM 20563 | NCTC 10713, X58309, Stc.angino

*Streptococcus australis* [VP] Willcox et al. 2001 - AI-1 | ATCC 700641, AY485604, AF184974 | NCTC 13166

*Streptococcus bovis* [AL] Orla-Jensen 1919 = *Streptococcus equinus* (senior heterotypic synonym) - Pearl 11 | ATCC 33317, AB002482, Stc.bovis3 | ATCC 33317, M58835, Stc.bovis | DSM 20480 | NCDO 597, AB002482, Stc.bovis3 | NCDO 597, X58317, Stc.bovis1 | NCTC 8177

*Streptococcus canis* [VP] Devriese et al. 1986 - STR-T1 | ATCC 43496, AB002483, Stc.canis2 | DSM 20715, AB002483, Stc.canis2 | DSM 20715, X59061, Stc.canis

†*Streptococcus caprinus* [VP] Brooker et al. 1996 = *Streptococcus gallolyticus* (senior heterotypic synonym) - TPC 2.3 | ACM 3969, Y10868, Stc.gallyt

*Sporichthya polymorpha* [AL (T)] Lechevalier et al. 1968 - ATCC 23823 | DSM 43042 | NBRC 12702, AB025317 | IMRU 3913 | KCC A-0089

*Sporichthya brevicatena* [VP] Tamura et al. 1999 - YU720-21, AB006164 | NBRC 16195

Family V. *Acidothermaceae* [VP]

*Genus I. Acidothermus* [VP (T)]

*Acidothermus cellulolyticus* [VP (T)] Mohagheghi et al. 1986 - 11B | ATCC 43068, X70635, Acdt.cellu | DSM 8971

Family VI. *Kineosporiaceae* [468]

*Genus I. Kineosporia* [AL]

*Kineosporia aurantiaca* [AL (T)] Pagani and Parenti 1978 - A/10312 | ATCC 29727, X87110, Ks.auranti | DSM 43858 | NBRC 13890 | NBRC 14067, D86937, Ks.aurant3 | JCM 3230, AB003931, Ks.aurant2 | KCC A-0230

*Kineosporia mikuniensis* [VP] Kudo et al. 1998 - I-463 | JCM 9961

*Kineosporia rhamnosa* [VP] Kudo et al. 1998 - I-132, AB003935, Ks.rhamno2 | JCM 9954, AB003935, Ks.rhamno2

*Kineosporia rhizophila* [VP] Kudo et al. 1998 - I-449, AB003933, Ks.rhizoph | JCM 9960, AB003933, Ks.rhizoph

*Kineosporia succinea* [VP] Kudo et al. 1998 - I-273, AB003932, Ks.succine | JCM 9957, AB003932, Ks.succine

*Genus II. Cryptosporangium* [VP]

*Cryptosporangium arvum* [VP (T)] Tamura et al. 1998 - YU 629-21, D85465, Cs.arvum1 | NBRC 15965, D85465, Cs.arvum1

*Cryptosporangium aurantiacum* [VP] Tamura and Hatano 2001 [469] - 71–C38 | DSM 46144 | NBRC 13967, AB047490 | JCM 3241

*Cryptosporangium japonicum* [VP] Tamura et al. 1998 - YU 636-3, D85466, Cs.japonic | NBRC 15966, D85466, Cs.japonic

*Cryptosporangium minutisporangium* [VP] (Ruan et al. 1986) Tamura and Hatano 2001 <- *Actinoplanes minutisporangius* (basonym) - A-60 | LL-A-60 | IMRU LL-A-6 | ATCC 49415 | NBRC 15962, AB037007 | JCM 9458

*Genus III. Kineococcus* [VP]

*Kineococcus aurantiacus* [VP (T)] Yokota et al. 1993 - RA 333 | DSM 7487, D17527, Knc.aurnat | NBRC 15268, X77958, Knc.aurna2

*Kineococcus radiotolerans* [VP] Phillips et al. 2002 - SRS30216, AF247813 | ATCC BAA-149 | DSM 14245

Suborder XVII. *Glycomycineae* [VP]

Family I. *Glycomycetaceae* [VP]

*Genus I. Glycomyces* [VP (T)]

*Glycomyces harbinensis* [VP (T)] Labeda et al. 1985 - LL-DO5139 | ATCC 43155 | DSM 46494 | IAM 14283 | NBRC 14487, D85483, Gm.harbnen | IMET 43812 | JCM 7347 | NRRL 15337

*Glycomyces rutgersensis* [VP] Labeda et al. 1985 - LL-I-20 | ATCC 43156 | DSM 43812 | IMET 43813 | NBRC 14488, D85484 | NRRL B-16106

*Glycomyces tenuis* [VP] Evtushenko et al. 1991 - ATCC 49849 | DSM 44171 | NBRC 15904, D85482, Gm.tenuis1 | INA n-5888 | JCM 9087 | VKM Ac-1250

Order II. *Bifidobacteriales* [VP 470]

*Family I. Bifidobacteriaceae* [VP]

*Genus I. Bifidobacterium* [AL (T)]

[468] Ludwig indicates that ARB tree may not support this placement. Unpublished data of Garrity and Searles supports this family.

[469] Note that a subculture of the type strain is only deposited in one public collection or may otherwise be in violation of Rules 27(3) and/or 30(3a-b,4) as emended by the Judicial Commission in 1999 (IJSEM 50: 2239–2244).

[470] Although Ludwig has expressed some reservations about the placement of the *Bifidobacteriales*, PCA plots (Garrity and Lilburn) clearly show the *Bifidobacteria* are removed from the main lineages of *Actinobacteria*.

*Bifidobacterium bifidum* [AL (T)] (Tissier 1900) Orla-Jensen 1924 - ATCC 29521, M38018, Bif.bifidu | DSM 20456, S83624, Bif.bifid3 | JCM 1255 | Ti

*Bifidobacterium adolescentis* [AL] Reuter 1963 - biotype a | E194a | ATCC 15703, M58729, Bif.adoles | DSM 20083 | NCTC 11814

*Bifidobacterium angulatum* [AL] Scardovi and Crociani 1974 - B677 | ATCC 27535, D86182 | DSM 20098

*Bifidobacterium animalis* [AL] (Mitsuoka 1969) Scardovi and Trovatelli 1974 - R101-8 | ATCC 25527, X70971, Bif.animal | DSM 20104

*Bifidobacterium asteroides* [AL] Scardovi and Trovatelli 1969 - C51 | ATCC 25910, M58730, Bif.astero | DSM 20089 | JCM 8230

*Bifidobacterium boum* [AL] Scardovi et al. 1979 - RU917 | ATCC 27917 | DSM 20432 | JCM 1211, D86190

*Bifidobacterium breve* [AL] Reuter 1963 - S1 | ATCC 15700, M58731, Bif.breve | DSM 20213 | NCTC 11815

*Bifidobacterium catenulatum* [AL] Scardovi and Crociani 1974 - B669 | ATCC 27539, M58732, Bif.catenu | DSM 20103

*Bifidobacterium choerinum* [AL] Scardovi et al. 1979 - ATCC 27686, D86186 | DSM 20434 | SU806

*Bifidobacterium coryneforme* [VP] Biavati et al. 1982 - C-215 | ATCC 25911, M58733, Bif.coryne | DSM 20216

*Bifidobacterium cuniculi* [AL] Scardovi et al. 1979 - ATCC 27916, M58734, Bif.cunicu | DSM 20435 | RA93

†*Bifidobacterium denticolens* [VP] Crociani et al. 1996 -> *Parascardovia denticolens* - B3028 | AS1.2280, AF240565 | DSM 10105, D89331

*Bifidobacterium dentium* [AL] Scardovi and Crociani 1974 - B764 | ATCC 27534, D86183 | DSM 20436

*Bifidobacterium gallicum* [VP] Lauer 1990 - P6 | ATCC 49850 | DSM 20093 | JCM 8224, D86189

*Bifidobacterium gallinarum* [VP] Watabe et al. 1983 - Ch206-5 | ATCC 33777 | DSM 20670 | JCM 6291, D86191

†*Bifidobacterium globosum* [VP] (ex Scardovi et al. 1969) Biavati et al. 1982 -> *Bifidobacterium pseudolongum subsp. globosum* - RU 224 | ATCC 25865, M58736, Bif.plongl | DSM 20092

*Bifidobacterium indicum* [AL] Scardovi and Trovatelli 1969 - C 410 | ATCC 25912, M58737, Bif.indicm | DSM 20214

*Bifidobacterium infantis* [AL] Reuter 1963 - S12 | ATCC 15697, X70974, Bif.infan6 | DSM 20088 | NCTC 11817

†*Bifidobacterium inopinatum* [VP] Crociani et al. 1996 -> *Scardovia inopinata* - B3109 | DSM 10107, AB029087

*Bifidobacterium lactis* [VP] Meile et al. 1997 - UR1, X89513, Bif.lactis | CIP 105265 | DSM 10140, X89513, Bif.lactis

*Bifidobacterium longum* [AL] Reuter 1963 - E194b | ATCC 15707, M58739, Bif.longum | DSM 20219 | NCTC 11818

*Bifidobacterium magnum* [AL] Scardovi and Zani 1974 - RA3 | ATCC 27540, M58740, Bif.magnum | DSM 20222

*Bifidobacterium merycicum* [VP] Biavati and Mattarelli 1991 - Ru915B | ATCC 49391 | DSM 6492 | JCM 8219, D86192

*Bifidobacterium minimum* [VP] Biavati et al. 1982 - F392 | ATCC 27538, M58741 | DSM 20102

*Bifidobacterium pseudocatenulatum* [AL] Scardovi et al. 1979 - B1279 | ATCC 27919 | DSM 20438 | JCM 1200, D86187

*Bifidobacterium pseudolongum subsp. pseudolongum* [AL] Mitsuoka 1969 - PNC-2-9G | ATCC 25526, M58742, Bif.plonpl | DSM 20099